

# Assignment 3

## Computer Graphics, Spring'24

### Dept. of CSE, IIT Kharagpur

Posted: 21st March 2024  
Due: 4th April 2024, 11:55 PM

#### Description

In this assignment you will be dealing with 3D meshes. The goal is to visualize and interact with a polygonal mesh using OpenGL features. You are given a polygonal mesh in `.ply` file format. In this file format, first few lines contain the details of the file (till `end_header`). Among several details, the number of vertices are declared in the line starting with `element vertex`, and the number of faces/triangles are declared in the line starting with `element face`. For example in the file `dog.ply`, there are 3400 vertices and 6677 triangles connecting the vertices. The actual data starts from the next line of `end_header`. The  $x$ ,  $y$ , and  $z$  coordinates of a single vertex are listed in columns, and all the vertex data are stored in rows. After the vertex list ends, the polygons connecting the vertex numbers are listed. The first number of these lines define the type of polygon used in modeling the mesh. For example if a line states “3 66 108 65”, it means that this is a triangular mesh and the current triangle connects vertex number 66, 108, and 65 in the sequential order.

First, read the `.ply` file and parse it to store the points and triangles in proper data structure. You might also need to compute the (face) normals of the triangles for the rendering. The next step is to visualize the mesh. Define and open a window, create a synthetic camera, define the light source, material properties (choose any colour as you wish), and display the triangle mesh in the window. Note that the face normals you have computed before, will be useful to get nice lighting effects. Following are some examples of visualization of the 3 meshes provided:



The next task is to incorporate some advanced features where the user is able to interact with the the mesh in three dimensions by rotating, translating, or scaling it, as well as able to perform zoom-in/zoom-out operations by mouse movements (clicking/scrolling).

Your task is to implement this in OpenGL using C/C++. Your program MUST compile in standard Linux based systems.

## Weightage

This assignment carries 15% of the total mark.

## What to submit?

Submit the program file(s) you have implemented. You must use OpenGL with C/C++ to implement the assignment. Put all the file(s) into a zip and submit in Moodle (no files will be accepted by email). Please do not submit any unnecessary files (such as the whole project).

## Plagiarism

Copying the code is a serious academic offence, which will be treated with zero tolerance. Any detection of plagiarism will give zero marks in the assignment.

## General marking scheme

The marks will be distributed as follows:

- Working program: 80%
  - Parsing the file and storing the data in proper data structure: 5%
  - Setting up the camera and light source: 10%
  - Display the mesh properly: 35%
  - User interaction by mouse click/scrolling: 20%
  - Aesthetic part: 10%
- Documentation: 10%
  - Main comment block identifying the student (name, roll number, email address): 4%
  - Defining input and output parameters for a function: 3%
  - Purpose of functions/blocks of code: 3%
- Program style: 5%
  - Meaningful variable names: 1%
  - Constants instead of “magic numbers”: 1%
  - Readability (complete sentences, indentation, white spaces, etc): 2%
  - Code flows “nicely”: 1%
- Program structure: 5%
  - Modular code: 2%
  - Uses appropriate data structure: 1%
  - Loops when needed/no loops when not needed: 2%