Mathematical Methods and Graphics 2006
Assessed Coursework

Goal: to put in practice the fundamental concepts learned in the lectures through problem solving and basic OpenGL programming.

Pre-requisites: to attend lecture and tutorial sessions
to experiment with the Java Personal OpenGL Tutorial – JPot
to make use of available OpenGL resources (www.opengl.org)

Submission: submit your answers to the department by Tuesday 7th March following the assessed work submission guidelines. If you answer the Bonus Question please also send a copy of your code to me (F.Bello@imperial.ac.uk) in a single file with your initial and surname in the filename.

1. A transformation of a graphical scene, using homogenous coordinates is given by the matrix:

2	1.3	1	0
-3	1.5	2.8	0
-1.3	2.2	1.8	0
-1.1	0.3	2	1

a) Use the JPot Transformation Matrix example to show the effect of the above transformation on the teapot (include a snapshot before and after applying the transformation)

b) Following this transformation, the points are to be projected orthographically onto the plane z=0. What is the combined matrix which will carry out the transformation and projection?

c) Use the JPot Transformation Matrix example to illustrate the result of applying the combined matrix (include a snapshot before and after applying the combined transformation)

2. Which OpenGL commands are used to perform: a) Orthographic Projections b) Perspective Projections.

c) Using the Orthographic Projection and Perspective vs. Orthographic examples in JPot briefly explain in your own words how each of the above commands performs its respective projection

d) Relate the arguments of each of the above commands to the standard definition of Orthographic and Perspective projections as presented in the lecture notes

3. A tetrahedron is defined by the following four points: [10,20,5] [5,10,5] [10,10,5] [10,10,10]

The tetrahedron is part of a graphics scene which is to be projected perspectively onto the plane z=-1 with the viewpoint at z=-6. Determine whether it will be totally visible in a window with corners at [0,0] [0,5] [5,0] and [5,5]. Sketch the output presented on the specified window.

4. For the tetrahedron of Q3, compute the inner surface normal for each face and check to see if the point [4,15,4] lies within the tetrahedron.

***** BONUS QUESTION *****
5. Using JOGL (https://jogl.dev.java.net/), write a program in Java that will draw the tetrahedron of Q3 and perform the specified perspective projection onto the given window.

NOTE: Both JPot and JOGL should already be installed on the DoC PC Linux systems.