

# COMP27112 Coursework Assignment 1

This material is examinable (the ideas, not the details)

The purpose of this Assignment is to:

- Get some experience of OpenGL programming.
- Get some experience of viewing using the OpenGL camera.

*Before you do this Assignment, make sure you have completed the tutorial part of your OpenGL manual.*

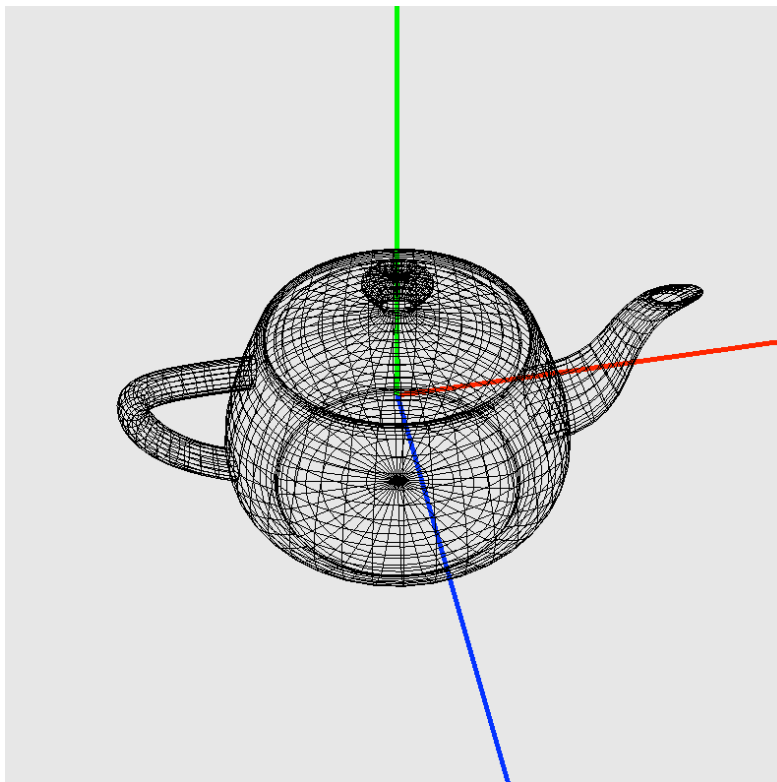
**Task 1:** Create a folder for your COMP27112 work, and within that folder, create a folder for this assignment called `cw1`. Move into `cw1` and copy the program we'll be using, `teapot.c`:

```
cp /opt/info/courses/COMP27112/Coursework/cw1/teapot.c .
```

Compile it using `cogl`:

```
$ cogl teapot.c
```

And run it. You should see something like this:



Here we have a view of a 3D teapot, centred on (0,0,0), and viewed by a camera positioned at (-2.0, 10.0, 10.0), looking at (0,0,0). The red, green and blue lines are respectively the X, Y and Z coordinate axes.

**Task 2:** The program responds to a few keys. To rotate the teapot 10 degrees about the X axis, press the **x** key (or the **X** key to rotate it the other way). And similarly use the **y** (**Y**) and **z** (**Z**) keys to rotate about the Y and Z axes. Try all these keys, and get a feel for their effects on the teapot. To reset the teapot to its original unrotated position, press the **r** key.

**Task 3:** Now open the program in your favourite editor and have a look at it. Do you understand the basic structure of the program? By now, you should. If not, refer to your OpenGL manual.

**Task 4:** Change the colour of the teapot. Locate this line in `Display()` :

```
glColor3f(0.0, 0.0, 0.0); // black
```

The arguments specify the colour as Red, Green, Blue components each in the range [0,1]. (0.0, 0.0, 0.0) is black. Edit the program to try some other values, recompile, and run again. Finally, make the teapot a nice purpley colour (Google for an RGB colour chart if you need it).

**Task 5:** Change the colour of the background. Locate this line in `Display()` :

```
glClearColor(0.9, 0.9, 0.9, 1.0); // grey
```

The arguments specify the colour as R, G, B and Alpha components each in the range [0,1]. (0.9, 0.9, 0.9, 1.0) is grey. Edit the program to try some other values (always use an Alpha of 1.0). Finally, make the background a nice yellowy colour.

**Task 6:** Now locate these lines in `Reshape()` :

```
gluLookAt(-2.0, 10.0, 10.0,    // camera position
          0.0,  0.0,  0.0,    // point to look at
          0.0,  1.0,  0.0 ); // "upright" vector

gluPerspective (50,(GLfloat) w/(GLfloat) h, 0.1, 80.0);
```

Experiment with changing these values. Try and get a feel for how the camera specification works. Finally, try and make the camera look “down the spout” of the teapot. You can do this with the teapot unrotated, or you can set a rotation in the program, and then set the camera suitably – it’s up to you, as long as you end up with a view looking down the spout.

**Task 7:** Now you should have a purpley teapot on a yellow background, and a camera view looking down the spout. In this final step you will save an image of this scene, and **submit** it. Run your program. To save the OpenGL window we'll use the **xwd** command, running that from another shell, so open a new shell window and in there (after **cd**-ing to your **cw1/** folder) type:

```
$ xwd >teapot.xwd
```

and a small crosshair will appear on the screen (it might beep too). Move the crosshair into the teapot window and left-click. This should result in the file **teapot.xwd** being written into your current folder. Check this by using the **xwud** command:

```
$ xwud -in teapot.xwd
```

and you should see the captured image displayed in a new window. Fiddle about until you're happy it's worked OK and that your captured image looks nice.

**Task 8:** This image is in a rather uncommon format (.xwd), so let's convert it into a GIF image. We'll do this using a very powerful free image manipulation library called "ImageMagick" ([www.imagemagick.org](http://www.imagemagick.org)). We'll use its "convert" function, which enables you to convert between almost any image formats you can think of. Do the following:

```
$ convert teapot.xwd teapot.gif
```

**Task 9:** Finally, **submit** your **teapot.gif**. You're finished.

**Optional extras.** If you're enjoying this and would like to try some optional extra things, here are a few ideas to get you going:

- Use keys to translate the teapot in X, Y and Z (easy).
- Use keys to scale the teapot in X, Y and Z (easy).
- Animate the camera so that it automatically flies around the teapot (less easy). Hints: define a simple circular motion path, and use the **idle()** function to nudge the camera along its path at each frame.