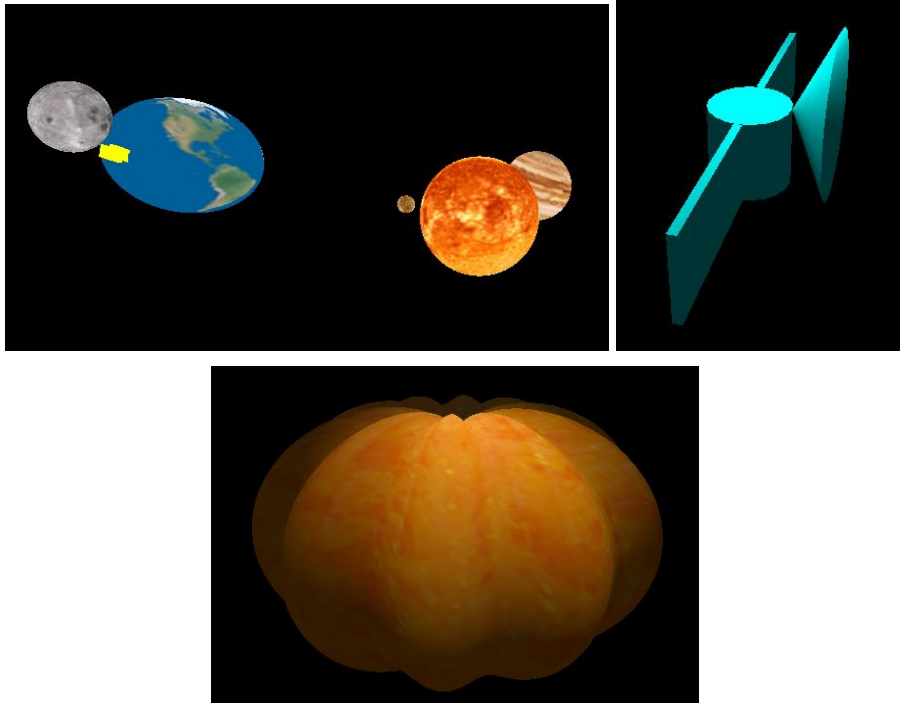# Computer Graphics Assignment 1
Deadline: 2017/11/2 23:59:59

In this assignment, we're goint to draw a mini Solar system with OpenGL. Please hand in your project file and report as **STUDENT_ID.zip** to e3 platform. (example: 0656602.zip)

If you have some special settings or additional functions, please also specify in your report.

example: the Solar system, the artificial satellite, and the bonus planet shape

Spec: (100% for total)

1. Draw the sun in the middle of the view. (5% = basic 2% + texture 3%)
   Add lighting effect at the position of the sun. (10%)
2. Draw the earth which revolves around the sun. Notice that the earth is not a perfect sphere, it should be flatter than a perfect sphere. (10% = basic 2% + revolve and rotate 2% + flat 3% + texture 3%)
3. Draw the moon revolves around the earth. Notice that the moon always face to the earth with same side. (10% = basic 2% + revolve and rotate 2% + facing 3% + texture 3%)
4. Draw an artificial satellite around the earth. You can use basic shapes in OpenGL to build an artificial satellite. The shape should look like the one in the example (right), that is, it should have a body, two boards, and a radar. The body should be a closed cylinder.
   (10% = basic 2% + revolve and rotate 2% + shape 3% + texture/color 3%)
5. Draw the jupiter revolves around the sun (8% = basic 2% + revolve and rotate 3% + texture 3%), and it has a satellite Europa (8% = basic 2% + revolve and rotate 3% + texture 3%) and an artificial satellite (10%, same as (4)).
6. Draw the mercury revolves around the sun. (8% = basic 2% + revolve and rotate 3% + texture 3%)
7. Use your own texture to draw another planet. (10% = basic 2% + revolve and rotate 3% + texture 5%)

8. Each object except the sun should have its own revolution speed and angle between its orbital plane and the reference (horizontal) plane. They should also have their own rotation speed and axial tilt.
9. Each astronomical object should have <u>different</u> texture on it. For the artificial satellites, you can use your own texture or just color them.
10. Please hand in a report to briefly explain how you finish the assignment, and also with pictures of your Solar system. (10%)
11. Please name your window with your student id.

<u>Bonus:</u>
1. Try to draw the shape of the planet without built-in functions and give it an irregular shape. (5%)

<u>Hint:</u>
1. You may use these functions below:

```
gluPerspective,glColorMaterial,glLightfv
glGenTextures,glBindTexture,glTexParameteri,glTexImage2D,glTexEnvf,
gluNewQuadric, glutSolidCube, gluSphere, …
```
and <u>some other functions mentioned in the class before</u>.

2. The side length of the texture image should be 2^N bit.
3. You can try the difference between GL_REPLACE and GL_MODULATE in the function glTexEnvf(GL_TEXTURE_ENV, GL_TEXTURE_ENV_MODE, GL_MODULATE);
4. You should bind a texture with its texture id, and then start to use it to draw (remember to enable), or adjust its parameter.
example:

```
glGenTextures(number of textures, array to store texture ids);
glBindTexture(GL_TEXTURE_2D, a texture id);
glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_MAG_FILTER, GL_LINEAR);
//scale linearly when image bigger than texture
glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_MIN_FILTER, GL_LINEAR);
glTexImage2D(GL_TEXTURE_2D, 0, 3, image_width, image_height,
0,GL_RGB, GL_UNSIGNED_BYTE, image_data);
glTexEnvf(GL_TEXTURE_ENV, GL_TEXTURE_ENV_MODE, GL_MODULATE);
```
5. You may need to disable LIGHTING or TEXTURE2D when drawing some objects.

Source code reference:
http://www.programming-techniques.com/2012/01/how-to-do-texture-mapping-in-opengl.html