Coursework Specification

G53GRA Computer Graphics 2018/2019

This document details the specification for the final coursework project worth 80% of your final mark for this module. It is due for submission on 15th May 2019. Late submissions will receive a penalty of 5% of the coursework grade per working day.

Requirements

In this coursework, you are required to apply what you have learnt about 3D computer graphics and OpenGL programming to *create and display a scene of your choice*. The coursework will not only test your understanding of the concepts of computer graphics, but also your ability to implement a 3D graphics scene.

When thinking about your coursework idea, you should take into account the topics covered in the lectures and lab sessions. The C++ Framework available on Moodle and the lecture demos should allow you to quickly create and display your own scene. The tutorials undertaken in the lab sessions have shown you how to create a basic scene, step-by-step, covering everything from hierarchical modelling, to lighting and texturing.

There are endless opportunities for you to explore in creating your scene. The minimum expected requirements for this coursework are as follows.

- Displays a virtual scene with *three or more* different 3D objects (**3D modelling / hierarchical modelling**);
- Has some well *animated objects* (**animation**);
- Looks *realistic* (**lighting and texturing**);
- Is set in a *thematic*, appropriate environment, e.g. with a skybox;
- Allows *user control*, e.g. for viewing (**keyboard and mouse input**)

Please note you may be import some models from elsewhere, but your coursework must include OpenGL programming.

You are also required to write a report documenting your work, outlining how you have met the requirements. The report should be *no more than four pages*, and contain screen-shots of your program. You should draw attention to any work you found challenging, and highlight particular aspects of your work that you think exceptional. You should also critically reflect on your coursework.

Techniques

This section details the graphics techniques that should be implemented in your coursework, to demonstrate your knowledge and skills.

Hierarchical Modelling

There are basic 3D models that can be created in OpenGL, such as cubes and spheres, but these alone will not give a reasonably detailed scene. You will need to combine these basic building blocks in a meaningful way that will produce convincing and aesthetically pleasing scenes. The OpenGL statements for manipulating matrix stacks, e.g. `glPushMatrix`, will help create more complex hierarchical models. You should create *at least three* different objects to display in your scene.

Animation

The scene you create should contain *at least one* animated object. There are examples in both the demos and tutorials for implementing animation.

Lighting & Texturing

In the lectures and labs, you are taught static point source lighting, which means you create a light source by specifying its location and properties. You will need to find appropriate images to texture the objects in your scene. The principle of texturing and the OpenGL statements required for texturing are covered, and you are also provided with functionality for reading a texture from file (.bmp only).

Viewing and projection

You are required to provide facilities to obtain different views of your scene from different positions and directions. For example, in first person shooters, the camera is set up as though it is the characters eye, whilst a third person setup would let the camera track or follow the character from behind as it moves around. To produce realistic images you will need to use perspective projection. You may want to experiment with the camera aspect ratio and field of view. To demonstrate your scene from different viewpoints, or add additional functionality, you will need to incorporate some input control using key presses and mouse clicks, as well as mouse motion.

Programming Support

As part of the coursework support, you are provided with a C++ Framework that contains a set of 'library' classes and functions that handle some of the work needed to display your scene, e.g. window handling, image loading, display loops, etc. This is made available for both Windows via Microsoft Visual Studio and macOS via XCode. The Framework has also been used to create the lecture demo code. Use of the framework is discretionary.

Submission

Submission should be made via Moodle. Two files should be submitted:

1) Your code should be compressed to a zip file (name the zip file 'C++(or Xcode)-yourName.zip') and uploaded to Moodle. **The zip file must include all the source files and the excutable file to run your code.**

2) Your report, in either pdf or Word, should be submitted seperately from the code. You should remember to identify yourself in the report.

The deadline for submission is **3pm 15th May 2019**. Late submissions will receive a penalty of 5% of the coursework grade per working day.

Before submitting your code, test it on the A32 lab machines using Visual Studio 2017 (except those using Xcode). Marks will be lost for programs that do not compile, or have issues with linking to image resources. Please ensure that you clean your project build before submission.

Demonstrations

As part of the assessment, you will be required to do a 5 minute demonstration of your scene to the lecturer or a tutor. Your demo will highlight your coursework features, and you will be required to answer questions about your scene and its implementation. This will be an opportunity to show off your knowledge and skills in computer graphics. The coursework demonstration is provisionally scheduled for 3pm, Monday 20th May 2019. You will be provided the location in A32 and a time slot for the demonstration in due time.

Marking Scheme

- Hierarchical Modelling (**20 marks**) Use OpenGL to draw the scene of your choice. The scene should be reasonable complex that tells some story. It should contain at least 3 different objects that have been coloured or textured.
- Animation (**15 marks**) Animate selected objects in your scene.
- Lighting and Texturing (**15 marks)**) Light and texture your objects, to create a sense of realism in your scene, in addition to a skybox.
- Creativity, ingenuity and the overall appeal of the scene (**10 marks**).
- Report (**10 marks**) Use no more than *four pages* to explain how your work meets each of the above requirements, drawing attention to any aspect of your project that you think particular challenging. You should demonstrate your work using (reasonably small) screenshots of the main outputs from your program. You should also critically reflect on your work.
- Demo (**10 marks**) You will have the opportunity to demonstrate your work in the labs to a tutor. You should demonstrate what you have done for modelling, animation, light, texture, and viewing.

Requirements for passing and distinction grades

To achieve a *passing grade (≥40%)* you will have

- Working scene, including modelling, animation, lighting and texturing
- Clear, comprehensible, and working code
- A working demo, with no issues to run
- A report describing your work clearly and coherently

To achieve a *distinction grade (≥70%)* you should have

- An impressive scene, demonstrating ingenuity and artistic flair, and/or self-learning.
- Well designed animation, lighting and texture, inclusing texturing a new *non-plannar* object.
- High quality demonstration that is impressive and engaging
- Clearly structured and extensively commented source code
- A well structured and detailed report describing your 3D scene and critically reflecting on the work you have done