School of Design and Informatics

Session 2021/22

Module Code: **CMP301**

Module Title: **Graphics Programming with Shaders**

Module Deliverer: **Mrs Erin Hughes**

Unit of Assessment: **Unit 1 of the module assessment – 100%**

Submission date: **Tuesday 11th January 2022.**

Suggested Feedback Return Date: **1st February 2022.**

Feedback Type: **Feedback will be provided via My Learning Space.**

Proposal

Write a short (1 – 1½ page) document outlining what you are planning to develop for your coursework and how it addresses the coursework brief. You must write about each "must contain" techniques detailed below. This document should include a short outline, a visual diagram and a project schedule. The outline of the application should state the graphical techniques being demonstrated and explain how they address the coursework brief. The diagram should support your outline by providing a rough visual on the scene you aim to develop. This can be an electronic sketch or a picture of a sketch; a simple drawing of the layout and contents of your planned scene. The project schedule should **detail** your development plan for the coursework; breaking down the coursework into tasks and the time allocated to these tasks. This could be a Gantt chart, project management timeline, checklist, milestones etc. The proposal will require some research of the required topics (e.g. post processing, lighting, etc). The emphasis of this task is the planning and feedback on your proposed coursework. Submit a PDF version of this document via the **Proposal** submission link on My Learning Space under the assessment block. Written feedback will be provided on My Learning Space.

Deadline: Friday 5th November 2021

Graphics Application (50%)

The main submission is a single application and supporting report. A starter application is provided via GitHub Classroom, this is also how the code aspect will be submitted. The starter application provides a free private repository for your coursework. You can sign up and gain access via the link on My Learning Space (under the assessment block). This will require a GitHub account. **Clone** the provided starter repository. For submission make sure all changes are **committed and pushed** by the submission deadline. On the submission deadline all repos will be automatically downloaded.

For the main submission you must develop your own shaders and an accompanying application to demonstrate them. Create a single scene to demonstrate the shaders created. This scene does not have to be overly large or populated; the focus is on the use of the programmable pipeline. The brief is designed to be as open as possible providing you the opportunity to develop something of your own interests and design. Ideally the coursework should demonstrate the use of all the shader stages: vertex, pixel, tessellation (including Hull and Domain), and geometry. The scene should demonstrate the following key graphical techniques:

- **Must** contain an example of vertex manipulation
    - Geometry could be algorithmically manipulated or based on provided data.
    - The geometry should be correctly textured
    - The geometry should be correctly lit, including proper normal calculation
    - Geometry should cast and receive shadows correctly
- **Must** contain a post processing technique
    - Applying full-screen filters and effects to a camera's image buffer before it is displayed to screen
    - Must be more complex than the blur discussed in class. Something like a simple grey scale filter is insufficient
- **Must** contain Lighting and shadows
    - All geometry **must** have correctly calculated/transformed normals and **must** make use of correct lighting and shadow algorithms.

For an improved grade your scene should also demonstrate:

- Tessellation
    - The tessellation should be non-trivial and impact the scene i.e. **do not** just tessellate a flat surface.
    - Tessellated geometry should be correctly textured, lit and cast/receive shadows.

    - A good example of tessellation would likely include dynamically controlled tessellation.
- Geometry Shader Stage
    - Non-trivial geometry generation or primitive manipulation
    - Geometry created or processed by this stage should be correctly textured and lit.

Your project should utilise an object-oriented approach with appropriate classes. All code should be well structured and well commented. You should differentiate your coursework from the example projects provided in lectures and labs. **Do not return my own code examples to me**. The application must run on the lab computers. The scene must demonstrate your ability to synthesise concepts from class into a single scene that demonstrates lighting, texturing, manipulation and post processing together, not separately.

Report (50%)

Your application **must** be accompanied by a 3000-3500-word report that will explain in detail how you addressed the coursework requirements. This report should include the following:

1. Overview of the scene
    - A short outline of what your coursework contains
    - How you have responded to the coursework brief
    - Outline any UI elements and controls beyond the standard controls
2. Detailed explanation of the techniques demonstrated
    - An in-depth explanation of what you built. What techniques (vertex manipulation/post processing/etc) are used and **how they work**
    - The report should discuss the how and why of the code
    - Explanation should include, important calculations used, data passed, and shader stages used
    - This should focus on the hlsl/shaders written
    - Providing diagrams, pseudocode and supporting screenshots as required as evidence
3. Critical reflection of the application
    - Critical reflection should focus on how and why things went wrong or right and how to take that forward to future projects
    - What worked, what didn't, **how**? **why**? what will you change in your next code project and what techniques will you carry forward?
    - What was learned that you could apply to future projects.
    - Offer possible solutions to the challenges or how it could be taken forward.
4. References
    - Reference any images, materials, models or techniques incorporated in your application. Cases of plagiarism will be taken very seriously. References must be Abertay Harvard Standard formatting.

Submission

Electronically via Github and My Learning Space by Tuesday 11th January 2022.

- The Code/Project solution is to be submitted via the provided **GitHub Repository**. This will be automatically downloaded on the date of submission. You must make the appropriate commit and push before the deadline.
- A standalone executable release version of the application and report should be submitted to **My Learning Space**. These files should be contained within a zip file for uploading, using the following folder structure:
    - A folder titled "hlsl" containing the hlsl files for the project.

- A folder titled "exe" containing the executable file and any shaders or other assets required for the project to run standalone.
- A PDF of your report.
- Zip files should be sensibly titled e.g. CMP301_JohnSmith.zip.

All submissions must be uploaded to the appropriate location within the My Learning Space system. You will be able to make multiple submissions (in case of errors) but only the last submission will be marked.

Marking scheme

Literal Grade	Evaluative Descriptor	This Assessment
A+	Excellent overall. • Demonstrates an excellent grasp of the subject matter. • Excellent capacity for original and creative enquiry. • Excellent ability to critically evaluate, analyse, synthesise and integrate complex information. • Excellent communication skills. In addition, exceptional in at least one of the above.	
A	Excellent overall. • Demonstrates an excellent grasp of the subject matter. • Excellent capacity for original and creative enquiry. • Excellent ability to critically evaluate, analyse, synthesise and integrate complex information. Excellent communication skills.	A meticulously constructed application demonstrating all the shader stages and utilising complex techniques independently researched by the student. Demonstrating clear synthesis of the module content and learning outcomes. Report is well written, very detailed, with excellent critical reflection and correctly referenced. Application is well presented.
B+	Very good overall. • Demonstrates a very good grasp of the subject matter. • Very good capacity for original and creative enquiry. • Very good ability to critically evaluate, analyse, synthesise and integrate complex information. • Very good communication skills. In addition, excellent in at least one of the above but overall performance deemed to be very good.	
B	Very good overall. • Demonstrates a very good grasp of the subject matter. • Very good capacity for original and creative enquiry. • Very good ability to critically evaluate, analyse, synthesise and integrate complex information. Very good communication skills.	A well-constructed application demonstrating many of the shader stages and utilising some techniques based on external research. Lacking in synthesis or complexity in places. Report is well written, detailed but could be improved in places. Some critical reflection and correctly referenced.
C+	Good overall. • Demonstrates a good grasp of the subject matter. • Good capacity for original and creative enquiry. • Good ability to critically evaluate, analyse, synthesise and integrate complex information. • Good communication skills	

	In addition, very good in at least one of the above but overall performance deemed to be good.	
C	Good overall. • Demonstrates a good grasp of the subject matter. • Good capacity for original and creative enquiry. • Good ability to critically evaluate, analyse, synthesise and integrate complex information. Good communication skills	The constructed application demonstrates some of the shader stages and shows limited research into graphics techniques. Lacking complexity and synthesis. Documentation provides an overview of the work, but explanation is lacking detail in places. Lacking sufficient critical reflection.
D+	Satisfactory overall. • Demonstrates a satisfactory grasp of the subject matter but limited grasp in some areas • Satisfactory capacity for original and creative enquiry. • Satisfactory ability to critically evaluate, analyse, synthesise and integrate information. Satisfactory communication skills	
D	Adequate. Achievement of all threshold standards but grasp of some subject areas and graduate attribute development may be more limited.	The application meets the minimum requirements. Lacking extra shader stages or complexity. Lacking complexity or suffering from technical issue. Documentation describes the application but lacking in detail throughout.
MF	Marginal fail. Performance just below the threshold standard. A reasonable expectation that a pass is achievable by reassessment without the need to repeat the module.	A very simple application that fails to meet the minimum requirements. Relies too heavily on provided class examples. Poor documentation lacking sufficient information on the application constructed. Fails to demonstrate understanding of core concepts.
F	Performance well below the threshold level. Some limited evidence of achievement of the outcomes.	No working application or largely provided code from class or little evidence of work. Documentation lacking detail or missing.
NS	No assessments submitted or no evidence of achievement of the outcomes.	