COMPUTING ARTEFACT

Version 1.0
Computing
COMP220

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Introduction

In this assignment, you are required to **design** and **implement** a C++ program using SDL and OpenGL or a program where the components could be integrated into your group project. This program should demonstrates the type of 3D computer graphics techniques that appear in a modern game engine.

Graphics technology is one of the most obvious areas in which innovation has driven gaming technology in recent years. Modern gaming PCs and consoles contain powerful graphics processing units (GPUs), and gamers expect modern games to push this hardware to its full potential. In this assignment you will practice the use of advanced graphical effects. Your final product will be a portfolio piece, which you can use in future to demonstrate your mastery of these techniques. This portfolio piece will be built up using a series of Worksheets, worksheet A and B will give you a foundational framework for the rest of the assignment which will be completed in C and D.

"Because of the nature of Moore's law, anything that an extremely clever graphics programmer can do at one point can be replicated by a merely competent programmer some number of years later."

— John Carmack

"Currently computer graphics are used a great deal, but it can be excessive."

— Hayao Miyazaki

This assignment is formed of several parts:

(A) Worksheet A - **Project Framework**
(B) Worksheet B - **Camera & Basic Scene**
(C) Worksheet C - **Demo specific work**
(D) Worksheet D - **Demo specific work & Viva**

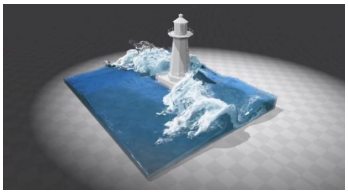
Assignment Setup

This assignment is a **programming** task. Fork the GitHub repository at the following URL:

`https://github.com/Falmouth-Games-Academy/COMP220-Computing-Artefact`

Use the existing directory structure and, as required, extend this structure with sub-directories. Ensure that you maintain the `readme.md` file.

Modify the `.gitignore` to the defaults for **Visual Studio**. Please, also ensure that you add editor-specific files and folders to `.gitignore`.



A demo of fluid simulation with NVIDIA's PhysX. Recent advances in GPU technology have enabled a wide range of high-fidelity real-time rendering and simulation effects.

Additional Guidance

As always, avoid underestimating the effort required to implement even simple software; always consider scope. From the proposal stage, you should consider very carefully what is feasible.

Your code will be assessed on **functional coherence**: how well the finished product corresponds to the user stories, and whether it has any obvious bugs. Correspondence to user stories runs both ways: implementing features that were not present in the design ("feature creep") is just as bad as neglecting to implement features.

Unlike your previous assignments, you will be assessed on the **performance** of your solution. Real-time graphics and simulation are not just about creating aesthetically pleasing effects, but doing so whilst maintaining a smooth and consistent framerate free of any lag or glitches that might frustrate the player. It may be necessary to trade-off the complexity or fidelity of an effect in order to achieve acceptable performance.

Your code will also be assessed on **sophistication**. To succeed on a project of this size and complexity, you will need to make use of appropriate algorithms, data structures, libraries, and object oriented programming concepts. Appropriateness to the task at hand is key: you will **not** receive credit for complexity where something simpler would have sufficed.

Maintainability is important in all programming projects, but doubly so when working in a team. Use **comments** liberally to improve code comprehension, and carefully choose the **names** for your files, classes, functions and variables. Use a well-established commenting convention for **high-level documentation**. The open-source tool Doxygen supports several such conventions. Also ensure that all code corresponds to a sensible and consistent **formatting style**: indentation, whitespace, placement of curly braces, etc. Hard-coded **literals** (numbers and strings) within the source should be avoided, with values instead defined as constants together in a single place. Consider allowing some literal values, where appropriate, to be "tinkered" without changing the source code, e.g. by defining them in an external file read at startup.

As with all assignments on this course, you are expected to display a level of **innovation and creative flair** befitting Falmouth University's reputation as a world-leading arts institution. One approach to promoting creativity is **divergent thinking**: generating ideas by exploring many possible solutions. Often the most interesting ideas are **subversive**: they deliberately go against convention or obvious solutions.

You will **not** be judged on the quality of your art assets. It is fine to use meshes and textures found online, as long as they are available under an appropriate license and are properly attributed.

FAQ

- **What is the deadline for this assignment?**
  Falmouth University policy states that deadlines must only be specified on the MyFalmouth system.
- **What should I do to seek help?**
  You can email your tutor for informal clarifications. For informal feedback, make a pull request on GitHub.
- **Is this a mistake?**
  If you have discovered an issue with the brief itself, the source files are available at:
  `https://github.com/Falmouth-Games-Academy/bsc-assignment-briefs`.
  Please make a pull request and comment accordingly.

Additional Resources

- `http://www.opengl-tutorial.org`
- `http://gamedev.stackexchange.com/questions/32876/good-resources-for-learning-modern-opengl-3-0-or-later`
- `https://google.github.io/styleguide/cppguide.html`

Marking Rubric

Criterion	Weight	Refer for Resubmission	Adequate	Competent	Very Good	Excellent	Outstanding
Worksheet A	10%	No or Late submission of worksheet	See worksheet for details				
Worksheet B	15%	No or Late submission of worksheet	See worksheet for details				
Worksheet C	25%	No or Late submission of worksheet	See worksheet for details				
Worksheet D	25%	No or Late submission of worksheet	See worksheet for details				
Maintainability	15%	There are no comments in the source code, or comments are misleading. Most variable names are unclear or inappropriate. Code formatting hinders readability.	The source code is only sporadically commented, or comments are unclear. Some identifier names are unclear or inappropriate. Code formatting is inconsistent or does not aid readability.	The source code is somewhat well commented. Some identifier names are descriptive and appropriate. An attempt has been made to adhere to code guidelines (Unreal, Google etc). There is little obvious duplication of code or literal values.	The source code is reasonably well commented. Most identifier names are descriptive and appropriate. Most code adheres to the to code guidelines (Unreal, Google etc). There is almost no obvious duplication of code or of literal values.	The source code is reasonably well commented, with Python doc-strings. Almost all identifier names are descriptive and appropriate. Almost all code adheres to the to code guidelines (Unreal, Google etc). There is no obvious duplication of code or of literal values. Some literal values can be easily "tinkered" in the source code.	The source code is very well commented in the doxygen style. All identifier names are descriptive and appropriate. All code adheres to the to code guidelines (Unreal, Google etc). There is no obvious duplication of code or of literal values. Most literal values are, where appropriate, easily "tinkered" outside of the source code.
Use of Version Control	10%	GitHub has not been used.	Source code has rarely been checked into GitHub.	Source code has been checked into GitHub at least once per week. Commit messages are present. There is evidence of engagement with peers (e.g. code review).	Source code has been checked into GitHub several times per week. Commit messages are clear, concise and relevant. There is evidence of somewhat meaningful engagement with peers (e.g. code review).	Source code has been checked into GitHub several times per week. Commit messages are clear, concise and relevant. There is evidence of meaningful engagement with peers (e.g. code review).	Source code has been checked into GitHub several times per week. Commit messages are clear, concise and relevant. There is evidence of effective engagement with peers (e.g. code review).

Appendix: Contract

You must **design** and **implement** a technical demo making use of 3D graphics techniques. The demo must meet the following requirements:

- A scene containing **at least one** textured mesh **and at least one** light source.
- Standard **first-person movement controls**:
  - The player can use the mouse to look up/down and to rotate in place;
  - The player can use the WASD keys and/or the arrow keys to move around the environment;
  - Other controls (e.g. interact, jump, shoot) should be added **if and only if** they are required for your concept.
  - Loading of meshes from a standard 3D object file format;
- At least **two** of the following graphics and simulation techniques:
  - Procedural generation of complex meshes or terrain;
  - Rendering of semi-transparent materials;
  - Realistic rendering of rough surfaces (e.g. normal mapping);
  - Skeletal animation or deformation;
  - Collision detection or ray-casting;
  - Integration of a third-party physics engine (e.g. Bullet, PhysX);
  - Particle effects (e.g. fire, smoke, fluid);
  - An advanced real-time lighting effect (e.g. shadow casting, reflections, volumetric lighting, bloom);
  - Non-realistic rendering (e.g. cel shading);
  - Other advanced rendering or simulation techniques of your choice, subject to discussion with your tutor and demonstration that you have researched the feasibility of your chosen techniques.
- Some aspect intended to create **fun and/or engagement** for the user, such as:
  - Exploring an environment in a "walking simulator" style; or
  - Interacting with a simulated system; or
  - Achieving a **simple** gameplay objective (beware of overscoping!)