

COMP 3501

Contact

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Course webpage: cuLearn

Overview

This is a course about the fundamentals of real-time computer graphics. We will use OpenGL and C++. The course provides both mathematical foundations and implementation practice. You should have some OpenGL knowledge from COMP 2501 and this course will build on that.

Textbooks and Resources

The official textbook is *Computer Graphics Programming in OpenGL with C++* by V. Scott Gordon and John Clevenger. We will be relying more heavily on the textbook than we would in an ordinary year. Morgan McGuire's *Graphics Codex* is an outstanding resource that will reward study; you can find it at www.graphicscodex.com.

You may also find various online tutorials and code fragments useful. You are free to make use of such material provided you credit the source. In particular, models and images found online are fair game. In past years, TurboSquid has been a source of free models for students to incorporate into their assignments and project.

Topics

The course's main topics include the following:

- Mathematical foundations: coordinate systems, vectors, matrices, quaternions
- Review of real-time rendering: the Z-buffer, pixel and vertex shaders
- Texture: texture mapping and texture synthesis
- Camera: translation, rotation, perspective, and camera control
- Illumination: the 3-term lighting model and alternatives
- Physical simulation: use of physics for animation of natural phenomena, particle systems, rigid-body motion

Additional topics, such as raytracing, shadows, and multipass shader effects, will be undertaken as time permits.

Grading Scheme

Assignments: 40%
Midterm and in-class quizzes: 15%
Course project: 15%
Final exam: 30%

Course Project

In an ordinary year, this course would include a group project. However, since the class is being held online, group work may be challenging for some students.

Accordingly, the course project will be reduced in scope this year. Projects will be done individually, or (at your option) in a group of two to three. The intent is for each student or group to create a small game or game demo integrating many of the technologies we studied during the term. Detailed project requirements will be discussed in class in the early part of the term.

Assignments

We will have several assignments throughout the term – approximately weekly, with some gaps. I expect every student to complete every assignment.

Assignment submissions are handled electronically, so assignment deadlines are firm. Do not wait until the last minute; rather, plan to submit at least 30 minutes in advance of the deadline.

For each assignment you will be submitting one or more files that contain source code. These files must be compressed into a “zip” file – never “rar” or other format.

Use good programming practices: thorough comments; good use of whitespace; breakdown into suitable functions; descriptive variable names. Plan your approach before writing any code (e.g., write some pseudocode, make some drawings). You may be asked to show your pseudocode to the instructor or TA before receiving help.

Academic Accommodation

The following text is from the template at students.carleton.ca/course-outline/.

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

- **Pregnancy obligation:** Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website.
- **Religious obligation:** Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website.
- **Academic Accommodations for Students with Disabilities:** If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor to ensure accommodation arrangements are made. For more details, visit the Paul Menton website.
- **Survivors of Sexual Violence:** As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit carleton.ca/sexual-violence-support.
- **Accommodation for Student Activities:** Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the policy.

Academic Integrity

The following text is from the template at students.carleton.ca/course-outline/.

The University Senate defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as ones own.” This can include:

- reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as ones own without proper citation or reference to the original source;
- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, or paraphrased material, concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another’s data or research findings;
- failing to acknowledge sources through the use of proper citations when using another’s works and/or failing to use quotation marks;
- handing in substantially the same piece of work for academic credit more than once without prior written permission of the course instructor in which the submission occurs.

Plagiarism is a serious offence that cannot be resolved directly by the course’s instructor. The Associate Dean of the Faculty conducts a rigorous investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of “F” for the course.

Academic Integrity in the Faculty of Science

The Faculty of Science takes academic integrity violations seriously; an “F” in the course is standard for a first offense, with more serious penalties possible. Further details about the policies of the Office of the Dean of Science can be found here:

<https://science.carleton.ca/academic-integrity/>