Carleton University
School of Computer Science
COMP 3501: Foundations of Game Programming and Computer Graphics
Fall 2017
Course Outline

Contact

Instructor: Oliver van Kaick
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Class Schedule

Classroom: University Centre 378
Class Times: Tuesdays and Thursdays, 14:35am - 15:55pm
Office hours: Tuesdays and Thursdays, 16:00pm - 16:30pm
Notes and references at cuLearn: https://culearn.carleton.ca/moodle/course/view.php?id=92825

Course Description

The course covers a variety of mathematical concepts, algorithms and software technologies relevant for the creation of 3D games and game engines.

Topics Covered

- Mathematical foundations: coordinate systems, vectors, vector operations, parametric equations, splines, matrices, quaternions
- Shape representation: parametric surfaces, triangle meshes
- Transformations: translation, rotation, scaling; composing transformations; hierarchical transformations
- Camera: the pinhole camera and perspective transformation; the quaternion camera model
- Illumination: the 3-term lighting model and alternatives
- Real-time rendering: rasterization and the Z-buffer; vertex, fragment and geometry shaders
- Textures: texture mapping and texture synthesis
- Visual effects: particle systems, screen-space effects
- Collision detection and scene management techniques

Learning outcomes

At the end of this course, students will be able to:
- Summarize the main components necessary for the development of a computer game based on 3D graphics.
- Explain the principles behind the fundamental techniques used for the creation of 3D scenes in computer graphics (the topics listed above), discussing the mathematical operations and algorithms involved in these techniques.
- Identify the most suitable techniques to create specific visual effects in a computer game.
- Implement a basic game in C++ with OpenGL graphics and auxiliary libraries.
- Write vertex, pixel and geometry shader programs of intermediate difficulty in the OpenGL Shading Language (GLSL).

Resources

We do not have an assigned textbook for the course. A standard book on computer graphics (e.g., Peter Shirley's **Fundamentals of Computer Graphics**) will be useful for revising the concepts covered in the course. For programming assignments and the course project, we will use a set of libraries that build on **OpenGL**. For detailed questions on programming with OpenGL, there are a wealth of books, websites, and online tutorials that provide information; a few recommendations are provided in the cuLearn page. You are free to make use of material found online provided you credit the source. In particular, models and images found online are fair game. Code fragments you take from an online source are allowed but do give credit and make sure you understand what the code is doing.

Evaluation

Grading scheme:

Assignments (approximately every two weeks): 25%

Midterm: 10%, around October

Course project: 25%, due at the end of classes

Final exam: 40%, scheduled centrally

Note that you need to obtain a passing grade on the midterm + final to pass the course.

CS Undergraduate Academic Advisor

The undergraduate advisor for the School of Computer Science is available in Room 5302C HP, by telephone at 520-2600, ext. 4364 or by email at undergraduate advisor@scs.carleton.ca. The advisor can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisor will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and the Writing Tutorial Services.

Centre for Student Academic Support (CSAS)
The Centre for Student Academic Support (CSAS) is a centralized collection of learning support services designed to help students achieve their goals and improve their learning both inside and outside the classroom. CSAS offers academic assistance with course content, academic writing and skills development. Visit CSAS on the 4th floor of MacOdrum Library or online at: carleton.ca/csas.

University Policies

Student Academic Integrity Policy

Every student should be familiar with the Carleton University student academic integrity policy. A student found in violation of academic integrity standards may be awarded penalties which range from a reprimand to receiving a grade of F in the course or even being expelled from the program or University. Some examples of offences are: plagiarism and unauthorized co-operation or collaboration. Information on this policy may be found in the Undergraduate Calendar.

Plagiarism

As defined by Senate, "plagiarism is presenting, whether intentional or not, the ideas, expression of ideas or work of others as one's own". Such reported offences will be reviewed by the office of the Dean of Science.

Unauthorized Co-operation or Collaboration

Senate policy states that "to ensure fairness and equity in assessment of term work, students shall not co-operate or collaborate in the completion of an academic assignment, in whole or in part, when the instructor has indicated that the assignment is to be completed on an individual basis". Please refer to the course outline statement or the instructor concerning this issue.

Academic Accommodations for Students with Disabilities

The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your **Letter of Accommodation** at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable**). Requests made within two weeks will be reviewed on a case-by-case basis**. After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) for the deadline to request accommodations for the formally-scheduled exam (if applicable).

Religious Obligation

Write to me 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: http://www2.carleton.ca/equity/

Pregnancy Obligation

Write to me 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: http://www2.carleton.ca/equity/

Medical Certificate

The following is a link to the official medical certificate accepted by Carleton University for the deferral of final examinations or assignments in undergraduate courses. To access the form, please go to http://www.carleton.ca/registrar/forms

Preliminary course outline subject to change; last updated on Wed Aug 09 2017.