Carleton University
School of Computer Science
COMP 4501: Advanced facilities for real-time games
Winter 2018
Course Outline

Contact

Instructor: Oliver van Kaick
E-mail: Oliver.vanKaick@carleton.ca
Office: HP 5348

TA: Ruohao (Jater) Xu
E-mail: <TBD>
Office: HP 1170

Class Schedule

Classroom: Tory Building 202
Class Times: Mondays and Wednesdays, 4:05pm – 5:25pm
Instructor's office hours: Mondays and Wednesdays, 5:30pm – 6:00pm, Tuesdays and Thursdays, 4:00pm – 5:00pm, HP5348
TA's office hours: <TBD>, HP1170
Notes and references in cuLearn: https://culearn.carleton.ca/moodle/course/view.php?id=98045

Course Description

The course covers the use of game engines for the development of computer games, and advanced techniques relevant to games, such as 3D rendering, animation, and the simulation of physics.

Topics Covered

- Architecture of games and game engines.
- Advanced rendering techniques: deferred rendering, global illumination heuristics, illumination models, physically-based rendering model.
- Animation: key-frame animation, mesh animation, character animation, locomotion.
- Rigid-body physics: collision detection, animation based on physical simulation.
- Introduction to soft-body physics.
- Shape modeling and acquisition.
- Networking, AI, pathfinding.

Learning outcomes

At the end of this course, students will be able to:

- Design the software architecture for a game of reasonable complexity, using a component-based architecture model.
- Summarize the main components that typically compose a game engine, explaining how these are integrated into a coherent software architecture, and how they can be used for game development.
- Explain the principles behind common techniques used for the creation of games, such as rendering, animation, and physical simulation. This includes the mathematical concepts and algorithms related to these techniques.
- Identify the most suitable techniques that can be used to add a specific functionality or effect to a computer game.
- Implement a game of reasonable complexity in the Unity engine, using 3D graphics.

Resources

We do not have an assigned textbook, as the course draws topics from a variety of areas. The following books are useful for the main topics discussed in the course:

- **Game engines:** Jason Gregory, "Game Engine Architecture", Second Edition, CRC Press, 2015.
- **Computer graphics:** Peter Shirley, Steve Marschner, "Fundamentals of Computer Graphics", Third Edition, CRC Press, 2009.
- **Real-time rendering, physically-based rendering:** Tomas Akenine-Möller, Eric Haines, and Naty Hoffman, "Real-time rendering", Third Edition, A. K. Peters, 2008.
- **Animation:** Rick Parent, "Computer Animation: Algorithms and Techniques", Third Edition, Morgan Kaufmann, 2012.

The programming assignments and course project will be based on OpenGL and the Unity Engine (https://unity3d.com/). There is a wealth of books and on-line tutorials specific to programming in Unity. I would advise to start by checking the tutorials provided in the Unity website.

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 + course project: 60%

Final (take home) exam: 40%

Note that you need to obtain a passing grade on the final exam 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.

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 Tue Dec 12 2017.