COMP 3501: Foundations of Game Programming and Computer Graphics

Contact

Instructor: Dr. David Mould
Email: mould@scs.carleton.ca
Office: HP 5346
Course webpage: on CULearn

Lectures T Th 16:00-17:30, Southam 505

Textbooks and 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 the high-level concepts in the course. For detailed questions about DirectX, there are a wealth of books, websites, and online tutorials that provide information; I will not make any particular recommendations among them. 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 found code is doing.

External libraries will probably be useful, e.g., for model loading. The DirectX Toolkit (DirectXTK) has many helpful classes for commonly performed tasks.

Topics

The course’s main topics include the following:

- Mathematical foundations: coordinate systems, vectors, vector operations, matrices, quaternions
- 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: numerical integration, kinematics, dynamics, particle systems, rigid-body motion

Additional topics, such as procedural modeling, raytracing, and visual special effects, will be undertaken as time permits.
Grading Scheme

Assignments (approximately weekly): 25%

Midterm: 15%, maybe on October 24

Course project: 20%, due at the end of classes

Final exam: 40%, scheduled centrally

Course Project

One of the main components of the course is a large project, to be undertaken in a group of 2 or 3 and to be presented in class. Your final submission will include your implementation, adequately documented, and a written report, not to exceed 10 pages. You should also plan to include an appendix of supplemental material, which can include technical details, additional screenshots, concept art, and anything else you think would be helpful to understanding your project.

In the 2013-2014 edition of the course, your project will be to create a stylized tank simulator. You are free to choose the art direction for the game, and many game design decisions will be up to you, but your project must include at least the following technical elements:

- Both first-person and third-person camera
- An environment containing a ground and multiple objects (at least dozens) such as trees, buildings, or rocks
- Hierarchical tank design with, at minimum, body, wheels, and turret
- Weapons fire with collision detection with targets and environment
- Particle systems effects, e.g., for weapon fire or explosions
- Collision detection between tank and other game objects
- Physical simulation of tank motion (driving, gravity, response to explosions)

Add additional features as your interest and expertise permit. The above elements are the minimum requirements; additional game elements such as multiple enemy types, visual special effects, sound effects, in-game resources, and missions and story, are all up to you to devise.

General Information and Regulations

COMP 3501 is governed by the academic regulations of Carleton University. The following information and regulations pertain generally to courses at Carleton and are not specific to 3501.
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.

Unauthorized Co-operation or Collaboration

Unless specifically otherwise indicated, collaboration on assignments is not permitted: every assignment submission is expected to be the result of individual effort. You may discuss problems and solutions with other students, and help one another fix bugs and such, but sharing of code is strictly forbidden. The project is intended as a collaborative effort within the group, and sharing of code between groups is also forbidden. For your information refer to the following Senate policy. 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”.

Equity Statements

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

Pregnancy obligation: write to the course 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: http://www2.carleton.ca/equity/

**Religious obligation:** write to the course 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: http://www2.carleton.ca/equity/

**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 the instructor 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). After requesting accommodation from PMC, meet with your instructor to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable) at http://www2.carleton.ca/pmc/new-and-current-students/dates-and-deadlines/

You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at http://www2.carleton.ca/equity/

**Medical Certificate**

The following is the URL of the official medical certificate accepted by Carleton University for the deferral of final examinations or assignments in undergraduate courses: http://www1.carleton.ca/registrar/forms/