

# **COMP 2501A - Computer Game Design and Development**

## **Winter 2023**

Carleton University  
School of Computer Science  
Course Outline  
Last update: December 20, 2022

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### **Course Information**

Instructor: Oliver van Kaick

Contact: Oliver.vanKaick at carleton.ca

Classroom: Please check the public class schedule

Lectures: Mondays and Wednesdays, 10:05am – 11:25am

Tutorials: Check your schedule on Carleton Central

Student hours: Information on student hours can be found in Brightspace

Course Website: <https://brightspace.carleton.ca/d2l/home/131266>

### **Teaching Assistants**

A list of teaching assistants and their contact/office hours information will be posted to Brightspace once the course starts.

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### **Course Summary**

Introduction to the practical development of computer games. The course covers a variety of mathematical concepts, algorithms, and software technologies relevant for the creation of 2D games. The course includes programming assignments.

### **Course Calendar Description**

Introduction to the practical development of computer games and engine architecture. Topics include: vector and matrix operations; coordinate systems and transformations; physical simulation; collision detection; AI; path planning; hardware-accelerated real-time rendering. Special attention is given to implementation of real-time rendering in a low-level language.

*Includes:* Experiential Learning Activity

*Prerequisite(s):* COMP 1501, COMP 2401 with a minimum grade of C-, and MATH 1104.

Lectures three hours a week, tutorial one and a half hours a week.

### **Topics Covered**

- Game architecture: MVC design pattern, game object management
- Mathematical foundations: vector operations, coordinate systems, and transformations
- Introduction to hardware-accelerated real-time rendering: geometry and shaders
- Introduction to OpenGL

- Physical simulation and collision detection
- Game AI and path planning

## 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 2D graphics and physical simulation.
- Explain the principles behind the fundamental techniques used for the creation of 2D games (the topics listed above), discussing the mathematical operations and algorithms involved in these techniques.
- Identify the most suitable techniques to create specific features in a 2D computer game.
- Implement a basic 2D game in C++ with OpenGL graphics and auxiliary libraries.

## Resources

We do not have an assigned textbook for the course. I recommend using Sanjay Madhav's *Game Programming: Algorithms and Techniques* as a reference for reviewing the different topics covered in the lectures. For the assignments and the course project, we will be programming in C++ and using a set of libraries that build on OpenGL. For detailed questions on programming with C++ and OpenGL, there are a wealth of books, websites, and online tutorials that provide information; a few recommendations are provided in the Brightspace page. You are free to make use of art assets found online provided that their license allows you to freely use the assets and you credit the source.

## Computer Requirement

For the programming assignments, you will need a computer that has a GPU suitable to run computer games using the OpenGL library. Recent Windows or Linux computers with GPU support should work fine. MacOS has discontinued support for OpenGL.

## Assessment Scheme

Grading scheme (the specific deadlines can be found in Brightspace):

- Assignments: 35%, approximately every two weeks.
- In-class exams: 15%, around February and March.
- Course project: 15%, due at the end of classes.
- Final exam: 35%, scheduled centrally, during exam week.

Note that you need to obtain a passing grade for the in-class exams + final to pass the course.

## Late Assignment Policy

Assignment deadlines are strict. The following scheme is applied to late submissions (which includes assignments and the final course project):

- 3 hours late: no penalty
- 3 to 12 hours late: -10%
- 12 to 24 hours late: -20%

- More than one day late: assignment receives a grade of zero.

Assignment submissions are handled electronically (i.e., through Brightspace). Technical problems do not exempt you from submitting on time. So, if you wait until the last minute and then have issues with your connection, you will receive a deduction according to the scheme above. Consequently, you are advised to:

- Periodically upload your progress (e.g., upload your progress to Brightspace after each major change; we will only grade your last submission).
- Submit your final work at least one hour in advance of the due date and time.
- Store backups of your assignments in the cloud, e.g., OneDrive, Dropbox, a private GitHub repository. However, your assignment has to be submitted to Brightspace so that we have a timestamped submission. URLs to the cloud will not be accepted.

The assignments consist of programming tasks. If any of the assignments that you submit does not compile or run, it will receive a mark of zero. Consequently, after you upload your submission to Brightspace, you should re-download it immediately and ensure that the project can be created with cmake, compiled, and run.

You are expected to demonstrate good programming practices at all times and your code may be penalized if it is poorly written. You are also expected to do the necessary preparatory work (i.e., devising an algorithm) before you start coding.

## **Academic Integrity**

If you are unsure about the expectations regarding academic integrity (how to use and cite references, how much collaboration with lab- or classmates is appropriate), ask your instructor. Sharing assignment specifications or posting them online (to sites like Chegg, CourseHero, OneClass, etc.) is considered academic misconduct. You are never permitted to post, share, or upload course materials without explicit permission from your instructor. Academic integrity offences are reported to the office of the Dean of Science. Penalties for such offences can be found on the ODS webpage: <https://science.carleton.ca/academic-integrity/>.

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## **Undergraduate Academic Advisors**

The Undergraduate Advisors for the School of Computer Science are available in Room 5302HP; or by email at [scs.ug.advisor@cunet.carleton.ca](mailto:scs.ug.advisor@cunet.carleton.ca). The undergraduate advisors can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisors will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services.

## **SCS Computer Laboratory**

Students taking a COMP course can access the SCS computer labs. The lab schedule and location can be found at: <https://carleton.ca/scs/tech-support/computer-laboratories/>. All SCS computer lab and technical support information can be found at: <https://carleton.ca/scs/tech-support/>. Technical support staff may be contacted in-person or virtually, see this page for details: <https://carleton.ca/scs/tech-support/contact-it-support/>.

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## **University Policies**

For information about Carleton's academic year, including registration and withdrawal dates, see [Carleton's Academic Calendar](#).

**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 [Equity Services](#).

**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 <https://carleton.ca/equity/focus/discrimination-harassment/religious-spiritual-observances/>.

**Academic Accommodations for Students with Disabilities** If you have a documented disability requiring academic accommodations in this course, please contact the Paul Merton Centre for Students with Disabilities (PMC) at 613-520-6608 or [pmc@carleton.ca](mailto: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 as soon as possible to ensure accommodation arrangements are made. For more details, visit the [Paul Merton Centre](#) 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 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](https://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](#).

**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. Examples of punishable offences include: plagiarism and unauthorized co-operation or collaboration. Information on this policy may be found [here](#).

**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. Standard penalty guidelines can be found [here](#).

**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.

## Special Information

It is important to remember that COVID is still present in Ottawa. The situation can change at any time and the risks of new variants and outbreaks are very real. There are number of actions you can take to lower your risk and the risk you pose to those around you including being vaccinated, wearing a mask, staying home when you're sick, washing your hands and maintaining proper respiratory and cough etiquette.

**Feeling sick?** Remaining vigilant and not attending work or school when sick or with symptoms is critically important. If you feel ill or exhibit COVID-19 symptoms do not come to class or campus. If you feel ill or exhibit symptoms while on campus or in class, please leave campus immediately. In all situations, you must follow Carleton's symptom reporting protocols.

**Masks:** Carleton has paused the COVID-19 Mask policy, but continues to strongly recommend masking when indoors, particularly if physical distancing cannot be maintained. It may become necessary to quickly reinstate the mask requirement if pandemic circumstances were to change.

**Vaccines:** While proof of vaccination is no longer required as of May 1 to attend campus or in-person activity, it may become necessary for the University to bring back proof of vaccination requirements on short notice if the situation and public health advice changes. Students are strongly encouraged to get a full course of vaccination, including booster doses as soon as they are eligible, and submit their booster dose information in cuScreen as soon as possible. Please note that Carleton cannot guarantee that it will be able to offer virtual or hybrid learning options for those who are unable to attend the campus.

All members of the Carleton community are required to follow requirements and guidelines regarding health and safety which may change from time to time. For the most recent information about Carleton's COVID-19 website and review the Frequently Asked Questions (FAQs). Should you have additional questions after reviewing, please contact [covidinfo@carleton.ca](mailto:covidinfo@carleton.ca).

**Doctor's note or medical certificate:** in effect for Fall 2022 term. In place of a doctor's note or medical certificate, students are advised to complete the [self-declaration form](#) available on the Registrar's Office website to request academic accommodation for missed course work including exams and assignments. Students should also discuss with the course instructor the required accommodations arising from the COVID-19 situation. Please check online for the latest policy in this regard for the Winter 2023 term.