

# COMP 3501A, Fall 2024 (Preliminary Version)

## Foundations of Game Programming and Computer Graphics

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### Course Information

Instructor: Dr. David Mould

Contact: mould@scs.carleton.ca

Office: HP 5346

Lectures: Tuesdays & Thursdays, 6:05 - 8:55

Course Website: on Brightspace

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### Course Calendar Description

The theory and practice of 3D graphics for computer games. Topics include: vectors and quaternions; hierarchical transformations; camera and perspective; hardware-accelerated real-time rendering; texture and texture mapping; illumination; and particle systems. Additional topics may include rigid-body motion, character animation, shadows, and screen-space special effects. Prerequisite(s): [COMP 2402](#) and ([COMP 2404](#) or [SYSC 3010](#) or [SYSC 3110](#)) and [COMP 2501](#).

### Content of the Course

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
- Screen-space special effects

Additional topics, such as raytracing, shadows, and spline interpolation, will be undertaken as time permits.

## Resources

The course will be taught using the Godot engine: [godotengine.org](https://godotengine.org). Please consult the Godot documentation for engine-related information.

There will be no official textbook in the 2024 offering. This is a transition year away from the previous offerings which used OpenGL. You may find the past textbook of some use: *Computer Graphics Programming in OpenGL with C++*, by V. Scott Gordon and John Clevenger.

Additional references include

- Morgan McGuire's *Graphics Codex*, an outstanding resource that will reward study.
- *Fundamentals of Computer Graphics*, by Steven Marschner and Peter Shirley; older editions contain less content but are still excellent.

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.

**Teaching Assistants** -- TBA

## Grading Scheme

Assignments (approximately weekly, ~8 total): 25 %

Midterm: 20%

Course project: 15%

Final exam: 40%

An assignment will be due each week (most weeks), usually involving a programming exercise. Submit assignments in Brightspace. Our intent is to return assignments within one week of submission.

Deadlines are modestly flexible: assignments will typically be due at midnight, and submissions up to a few hours late will be marked without late penalty. However, submissions received outside the grace period will not be graded barring highly unusual circumstances. Note that short-term technical problems (e.g., lost laptop) do not qualify for an extension; submit early and use the computers in the game lab as a backup. Start work early and submit partial progress periodically as you complete portions of the assignment.

For each assignment, you will be submitting one or more files that contain source code, and these files must be given the correct filename and be provided in the specified format. Assignments that are incorrectly named or in the incorrect format will be penalized and may receive a mark of zero.

## General Policies

### Academic Integrity

All code and documentation submitted for grading is expected to be the student's own work. Assignments are to be done individually unless specifically noted otherwise. Exams are closed-book, individual undertakings.

The following policy is in effect for this class:

*If you are unsure of the expectations regarding academic integrity (how to use and cite references, if unauthorized collaboration with lab- or classmates is permitted (and, if so, to what degree), then you must ASK your instructor. Sharing assignment or quiz specifications or posting them online (to sites like Chegg, CourseHero, OneClass, etc.) is ALWAYS 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. Information, process and penalties for such offences can be found on the ODS webpage: <https://science.carleton.ca/students/academic-integrity/>.*

The [Faculty of Science's Academic Integrity website](#) has additional information about academic integrity.

### Statement on use of AI

Many of the assessed activities in this course were designed to be completed by an individual working alone. Unless it is explicitly stated otherwise, the use of any AI system will be considered academic misconduct. This includes, but is not limited to, chatbots or code generators (e.g., ChatGPT, Google Gemini, Microsoft Copilot) and research assistants (e.g., Elicit).

Image generators such as Dall-E or Midjourney can be employed provided the output is clearly labeled and the prompt is provided. Note that AI-generated images might be suitable for use as concept art or for background images in your project, but are not a substitute for screenshots generated from your code.

### **SCS Laptop Requirement** (applies to all on-campus courses)

Every student that has been enrolled in a 1000-level (i.e., first year) course offered by the School of Computer Science after the 2020/2021 school year is required to have a laptop. This includes COMP1001, COMP1005, and COMP1006. For more information, please visit <https://carleton.ca/scs/scs-laptop-requirement/> and then review the requirements at <https://carleton.ca/scs/scs-laptop-requirement/laptop-specs/>

## 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:

- **Academic Accommodations**

Carleton is committed to providing academic accessibility for all individuals. Please review the academic accommodation available to students here: <https://students.carleton.ca/course-outline/>.

- **Academic Integrity**

**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 sanctioned with penalties which range from a reprimand to receiving a grade of F in the course, or even being suspended or expelled from the University. Examples of punishable offences include plagiarism and unauthorized collaboration. Any such reported offences will be reviewed by the office of the Dean of Science. More information on this policy may be found on the ODS Academic Integrity page: [Academic Integrity | Faculty of Science \(carleton.ca\)](https://carleton.ca/academic-integrity-faculty-of-science/).

**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. More information and standard sanction guidelines can be found here: <https://science.carleton.ca/students/academic-integrity/>. Please note that content generated by an unauthorized A.I.-based tool *is* considered plagiarized material.

**Unauthorized 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".