Computer Science 4053/5053 — Computer Graphics
Instructor: Chris Weaver
Spring 2025

Overview

Most interaction with data now happens through computer graphics. Even the display of simple text involves surprisingly advanced graphics processing. As a result, computer graphics is one of the most practical and broadly useful topics in computer science. It is also one of the most fun! Using graphics rendering technologies such as OpenGL, one can create a realistic or abstract virtual world with relatively little code. These worlds can support exploration, entertainment, education, and often a combination of all three. The availability and quality of computer graphics continues to increase rapidly thanks both to increasing hardware performance and ongoing research on rendering techniques.

This course provides a broad introduction to the theory and practice of computer graphics. We will cover both 2-D and 3-D techniques. Our main goals are to build substantial understanding and experience with the fundamentals of 2-D graphical data processing that support applications ranging from games to data visualization and simple, popular mobile games like platformers. Topics include coordinate systems and transformations, drawing, rendering, procedural and object-oriented graphical programming, interactive navigation, and applications to data visualization. You will learn about the popular graphics programming standard OpenGL, as well as some of its more useful extensions that allow for easier development and cross-platform deployment. Individual homework assignments will focus on programming and will be done in Java using the JogAmp JOGL library. You will also complete a semester-long team project, which can involve graphics technologies of your choosing, such as WebGL, JavaFX, Unity, Unreal Engine, etc.

Students in CS 5053 will develop an extra facet of their team's project, and individually implement and analyze a graphics technique from a research paper, as the two parts of their additional course workload.

General Information

Course Description: An introduction to computer graphics. Topics include coordinate systems, transformations, rendering in both two and three dimensions, and graphical programming. No student may earn credit for both 4053 and 5053. **CS 4053 Prerequisites:** CS 2413 or CS 2414, and CS 2813 or MATH 2513, and MATH 3333. **CS 5053 Prerequisites:** Graduate standing and CS 2413 or CS 2414, and CS 2813 or MATH 2513, and MATH 3333.

Format: Traditional In-Person / Lecture
Place: 130 Devon Energy Hall
Days: Tuesday+Thursday
Time: 4:30pm–5:45pm

Instructor: Chris Weaver
Email: cweaver@ou.edu
Office: 241 Devon Energy Hall
Office Hours: Tuesday 5:45pm–6:45pm (in person starting in DEH 130); Thursday 3:15pm–4:15pm (in person); Friday 11:00am–12:00pm (hybrid, Zoom meeting info TBA in Canvas); and by appointment.

Teaching Assistant: Skyler Riggle
Email: Skyler.D.Riggle-1@ou.edu
Office: ? DEH 210 (large CS Grad Lab); office hours will be held in DEH 115 (first floor Computer Lab)
Office Hours: TBD; and by appointment.

Materials

Class Web Pages:

• Canvas [4053] [5053]

Class Schedule: Refer to the *File/Schedule* folder in Canvas for the most recent version of the schedule. The schedule may change occasionally due to campus closures or other unforeseen circumstances.

Required Textbooks:

• F. S. Hill, Jr. and Stephen M. Kelley. *Computer Graphics using OpenGL*, 3rd Edition. Pearson/ Prentice-Hall, 2007. ISBN: 0-13-1496790-0 [OU Bookstore]

Software Resources:

• *Coding Tools:* Gradle [8.12], command line on your system, text editor of your choice
• *Desktop Libraries:* Java [Java SE 8; includes JavaFX 8]
• *Graphics Libraries:* Java Binding for the OpenGL API (JOGL) [2.5.0], WebGL
• *OpenGL Information:* The OpenGL SDK, The OpenGL "Red" Book
• *Popular Gaming Engines:* Unity, Unreal Engine, Godot Engine
• *Coding Environments (optional)*: IntelliJ IDEA, Visual Studio Code, Eclipse IDE for Java Developers

Evaluation (Assignments, Assessment, and Grades)

In this course you will be learning and applying computer graphics theory and practice. **Learning these topics involves progressive layers of practical knowledge and experience. This makes it essential that you attend class consistently and participate actively.** What you get out of this course will depend on what you put into it. The contributions to your grade are as follows:

• Team project: 40%, consisting of the following components ([1.00] total)
  • [0.05] Group Proposal *(~300 words, format TBA)*
  • [0.15] Group Plan *(~2100 words, format TBA)*
  • [0.10] Group Progress Report *(~1200 words, format TBA, plus peer evaluation forms)*
  • [0.15] Group Presentation *(around N minutes + N/2 minutes Q&A, N depending on the # of teams)*
  • [0.10] Group Poster *(during poster session on Friday afternoon of pre-finals week, format TBA)*
  • [0.20] Group Final Report *(~2100 words, format TBA, plus attachments and peer evaluation forms)*
  • [0.25] Individual contribution *(based on input from your teammates on peer evaluation forms)*

• Individual homework: 35% (25% for CS 5053), consisting of the following components ([1.00] total)
  • [0.16̄]x6 Graphics Implementations *(6 assignments)*

• Individual research & development mini-project: 10% (CS 5053 only)

• Final exam: 15% *(see below for details)*

• In-class participation: 10% *(based on quality and quantity of participation in class)*

The additional workload for students enrolled in CS 5053 has two components. The first component is an additional individual development thread within the team project. Each CS 5053 student will pursue a significant extra facet of discovery, design, implementation, and/or evaluation as an extension of their team's project. The length of each group assignment (written and oral) will increase by ~10% for each CS 5053 team member to document their extra work. The second component is an individual mini-project, which consists of: reading the student's choice of several classic research papers on non-photorealistic

rendering, implementing code to reproduce a graphics technique, analyzing the utility and usability of the result, and writing a short paper (~3 pages) in the style of peer-reviewed conference proceedings.

Due Dates: All assignments will be posted, collected, and returned through Canvas. Unless otherwise specified in writing, all assignments are due at the **exact** due date and time stated in Canvas (and at the top of each assignment's instructions) regardless of whether you hand them in electronically in Canvas, or physically on paper or otherwise (if allowed). The grade of any late assignment will be lowered by 10% per day late. No assignment will be accepted more than 72 hours after the original due date and time.

Presentations: The director of the School of Computer Science has granted permission to hold student presentations on Thursday of pre-finals week. Refer to the OU Final Exam Policies for more information.

Final Exam: The final exam is Friday, May 9, 2025 from 10:30am–12:30pm. No final exams can be given early, except as required by University policy. Refer to the OU Final Exam Policies for more information.

Grade Summary: I will store all of your grades in the Canvas online grade book. It is your responsibility to verify that the grades on Canvas are correct. If an error is found, bring the graded item to me and I will correct the online entry.

Grade Questions: To maintain fairness in grading, I prefer that any disagreement be brought to me within a week of the item being returned.

Borderline Grades: Borderline final grades will be decided by your in-class participation. This means that being an active participant in class can push you over a grade boundary.

Letter Grades: Your weighted total score for the course will be converted into a letter grade using a scale no higher than a "straight scale" (90+=A, 80–89=B, 70–79=C, 60–69=D, below 60=F). The scale may be lowered at the end of the semester at my discretion.

Course Policies

The following set of rules will help keep us all on the same page all semester and help to ensure fair treatment for all students.

Academic Integrity: Cheating is strictly prohibited at OU because it devalues the degree you are working hard to get. As a member of the OU community it is your responsibility to protect your educational investment by knowing and following the rules. For specific definitions on what constitutes cheating, review the *Student's Guide to Academic Integrity* at https://www.ou.edu/integrity/students.

All work submitted for an individual grade (or group grade), such as a homework or project assignment, should be the work of that single individual (or group), not their friends, a tutor, or other form of outside help. On examinations and quizzes you will never be permitted to use your notes, textbooks, calculators, or any other study aids. Should you see someone else engaging in this behavior, I encourage you to report it to myself or directly to the Office of Academic Integrity Programs. That student is devaluing not only their degree, but yours, too. Be aware that it is my professional obligation to report academic misconduct, which I will not hesitate to do. Sanctions for academic misconduct can include expulsion from the University and an F in this course, so don't cheat. It's simply not worth it.

Project Code: Your project code and write ups must be written exclusively by you or your group. *Use of any downloaded code or code taken from a book (whether documented or undocumented) is considered academic misconduct and will be treated as such.* Exceptions to this policy (such as a course project that builds on an existing open-source project) may be granted but you **MUST** obtain approval from me first.

Generated Materials: All materials submitted or presented as a part of an assignment must be human generated exclusively by you or your group, except for materials either included with or explicitly required by the assignment instructions. *Use of any automatically generated text, images, code, or other materials (such as from GPT or DALL-E) is considered academic misconduct and will be treated as such.* Exceptions to this policy (such as a course project that builds on an artificial intelligence image generation algorithm) may be granted but you **MUST** obtain approval from me first.

Copyright Syllabus Statement: Sessions of this course may be recorded or live-streamed. These recordings are the intellectual property of the individual faculty member and may not be shared or reproduced without the explicit, written consent of the faculty member. In addition, privacy rights of others such as students, guest lecturers, and providers of copyrighted material displayed in the recording may be of concern. Students may not share any course recordings with individuals not enrolled in the class, or upload them to any other online environment.

Classroom Conduct: Disruptions of class are not permitted. No electronic devices may be used during class except to take notes or as a direct part of class exercises. Examples of disruptive behavior include:

- Allowing a cell phone or other device to make audible sound.
- Browsing, listening to music, or playing computer games, regardless of whether they are visible or audible to other class members. (Such activities disrupt YOUR ability to pay attention and participate.)
- Exhibiting erratic or irrational behavior.
- Behavior that distracts the class from the subject matter or discussion.
- Making physical or verbal threats to a faculty member, teaching assistant, or class member.
- Refusal to comply with faculty direction.

In the case of disruptive behavior, I may ask that you leave the classroom and may charge you with a violation of the [Student Rights and Responsibilities Code](#).

Course Web Page: Access the Canvas website using your 4+4 (first four letters of your last name followed by the last four digits of your student number) and your standard OU password. If you have general difficulty with Canvas, please read the online OU IT documentation or call them at 325-HELP. All handouts and assignments will be made available in Canvas. You should check the site regularly. When I update the site with something important, I will post an announcement telling you what has been added and where it is located. You are responsible for things posted on the site after a 24 hour delay or the end of the first following class meeting, whichever occurs first.

Course Announcements: Announcements will be posted in Canvas. It is your responsibility to:

- Set up Canvas to receive notification of course announcements, class and group forum messages, and updates to course content including posting of assignments.
- Make sure that your contact info in Canvas includes an email address that you read regularly. I'll send out at least one class-wide message during the first week of class. If you do not receive this message, it is your responsibility to get the problem resolved immediately.
- Have your email program set up properly so that replying to your email will work correctly the first time. You can send email to yourself and reply to yourself to test this.

If you need assistance in accomplishing any of these tasks, contact [OU IT](#).

Course Communications: The *General Discussion* in Canvas should be the primary method of communication outside of class. This allows everyone in the class to benefit from the answer to your question. If you email me a question of general interest, I may post your question and my answer to the discussion. Matters of personal interest should be directed to email instead of to the discussion, e.g. informing me of an extended personal illness.

Incompletes: The grade of *I* is intended for the rare circumstance when a student who has been successful in a course has an unexpected event occur shortly before the end of the course. I will not consider giving a student a grade of *I* unless all three of the following conditions have been met: (1) it is within two weeks of the end of the semester; (2) the student has a grade of *C* or better in the class; (3) the reason that the student cannot complete the class is properly documented and compelling.

Evaluating the Course: The College of Engineering utilizes student ratings as one of the bases for evaluating the teaching effectiveness of each of its faculty members. The results of these forms are important data used in the process of awarding tenure, making promotions, and giving salary increases. In addition, the faculty uses these forms to improve their own teaching effectiveness. The original request for the use of these forms came from students, and it is students who eventually benefit most from their use. Please take this task seriously and respond as honestly and precisely as possible, both to the machine-scored items and to the open-ended questions.

I reserve the right to add, remove, or change any element or policy of this course, including evaluation percentages, at any time and for any reason, within the limits of University policy.

Mental Health Support Services

Support is available for any student experiencing mental health issues that are impacting their academic success. Students can either been seen at the University Counseling Center (UCC) located on the second floor of Goddard Health Center or receive 24/7/365 crisis support from a licensed mental health provider through TELUS Health. To schedule an appointment or receive more information about mental health resources at OU please call the UCC at 405-325-2911 or visit University Counseling Center. The UCC is located at 620 Elm Ave., Room 201, Norman, OK 73019.

Title IX Resources and Reporting Requirement

The University of Oklahoma faculty are committed to creating a safe learning environment for all members of our community, free from gender and sex-based discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking, in accordance with Title IX. There are resources available to those impacted, including: speaking with someone confidentially about your options, medical attention, counseling, reporting, academic support, and safety plans. If you have (or someone you know has) experienced any form of sex or gender-based discrimination or violence and wish to speak with someone confidentially, please contact OU Advocates (available 24/7 at 405-615-0013) or University Counseling Center (M-F 8 a.m. to 5 p.m. at 405-325-2911).

Because the University of Oklahoma is committed to the safety of you and other students, and because of our Title IX obligations, I, as well as other faculty, Graduate Assistants, and Teaching Assistants, are mandatory reporters. This means that we are obligated to report gender-based violence that has been disclosed to us to the Institutional Equity Office. This means that we are obligated to report gender-based violence that has been disclosed to us to the Institutional Equity Office. This includes disclosures that occur in: class discussion, writing assignments, discussion boards, emails and during Student/Office Hours. You may also choose to report directly to the Institutional Equity Office. After a report is filed, the Title IX Coordinator will reach out to provide resources, support, and information and the reported information will remain private. For more information regarding the University's Title IX Grievance procedures, reporting, or support measures, please visit Institutional Equity Office at 405-325-3546.

Reasonable Accommodation Policy

The University of Oklahoma (OU) is committed to the goal of achieving equal educational opportunity and full educational participation for students with disabilities. If you have already established reasonable accommodations with the Accessibility and Disability Resource Center (ADRC), please submit your semester accommodation request through the ADRC as soon as possible and contact me privately, so that we have adequate time to arrange your approved academic accommodations.

If you have not yet established services through ADRC, but have a documented disability and require accommodations, please complete ADRC's pre-registration form to begin the

registration process. ADRC facilitates the interactive process that establishes reasonable accommodations for students at OU. For more information on ADRC registration procedures, please review their Register with the ADRC web page. You may also contact them at (405)325-3852 or adrc@ou.edu, or visit www.ou.edu/adrc for more information.

Note: disabilities may include, but are not limited to, mental health, chronic health, physical, vision, hearing, learning and attention disabilities, pregnancy-related. ADRC can also support students experiencing temporary medical conditions.

Religious Observance

It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty. [See Faculty Handbook 3.15.2]

Adjustments for Pregnancy/Childbirth Related Issues

Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact the Accessibility and Disability Resource Center at 405/325-3852 and/or the Institutional Equity Office at 405/325-3546 as soon as possible. Also, see the Institutional Equity Office FAQ on Pregnant and Parenting Students' Rights for answers to commonly asked questions.

Final Exam Preparation Period

Pre-finals week will be defined as the seven calendar days before the first day of finals. Faculty may cover new course material throughout this week. For specific provisions of the policy please refer to OU's Final Exam Preparation Period policy.

Emergency Protocol

During an emergency, there are official university procedures that will maximize your safety.

Severe Weather: If you receive an OU Alert to seek refuge or hear a tornado siren that signals severe weather.

1. Look for severe weather refuge location maps located inside most OU buildings near the entrances.
2. Seek refuge inside a building. Do not leave one building to seek shelter in another building that you deem safer. If outside, get into the nearest building.
3. Go to the building's severe weather refuge location. If you do not know where that is, go to the lowest level possible and seek refuge in an innermost room. Avoid outside doors and windows.
4. Get in, Get Down, Cover Up
5. Wait for official notice to resume normal activities.

Additional Weather Safety Information is available through the Department of Campus Safety.

The University of Oklahoma Active Threat Guidance

The University of Oklahoma embraces a Run, Hide, Fight strategy for active threats on campus. This strategy is well known, widely accepted, and proven to save lives. To receive emergency campus alerts, be sure to update your contact information and preferences in the account settings section at one.ou.edu.

RUN: Running away from the threat is usually the best option. If it is safe to run, run as far away from the threat as possible. Call 911 when you are in a safe location and let them know from which OU campus you're calling from and location of active threat.

HIDE: If running is not practical, the next best option is to hide. Lock and barricade all doors; turn of all lights; turn down your phone's volume; search for improvised weapons; hide behind solid objects and walls; and hide yourself completely and stay quiet. Remain in place until law enforcement arrives. Be patient and remain hidden.

FIGHT: If you are unable to run or hide, the last best option is to fight. Have one or more improvised weapons with you and be prepared to attack. Attack them when they are least expecting it and hit them where it hurts most: the face (specifically eyes, nose, and ears), the throat, the diaphragm (solar plexus), and the groin.

Please save OUPD's contact information in your phone.

NORMAN campus: *For non-emergencies call (405) 325-1717. For emergencies call (405) 325-1911 or dial 911.*

TULSA campus: *For non-emergencies call (918) 660-3900. For emergencies call (918) 660-3333 or dial 911.*

Fire Alarm/General Emergency

If you receive an OU Alert that there is danger inside or near the building, or the fire alarm inside the building activates:

1. *LEAVE* the building. Do not use the elevators.
2. *KNOW* at least two building exits
3. *ASSIST* those that may need help
4. *PROCEED* to the emergency assembly area
5. *ONCE safely outside, NOTIFY first responders of anyone that may still be inside building due to mobility issues.*
6. *WAIT* for official notice before attempting to re-enter the building.

OU Fire Safety on Campus