



Course Snapshot

Programming Math and Physics for Games CSCE 4255 001

Term: 2026 Fall

Modality: In Person

Meeting Information: TR, 09:05AM-10:25AM, NTDP F204

Instructor Information

Name: Jonathon Doran

UNT Email Address: Jonathon.Doran@unt.edu

Office Hours and Location

Student hours held in-person in NTDP E260L

Zoom is available via appointments. Feel free to schedule appointments if the official hours do not work for you. If the list of times on Calendly does not work for you, please email me with your requested times.

Day	Time
Tuesday	2:30pm - 3:30pm
Wednesday	11:00am - 12:00pm
Friday	1:00pm - 2:00pm

[Book a meeting using Calendly](#)

Please put the course number in your subject line for all email communication. Canvas does that automatically

Office or Department Phone Number: Please contact me via Teams or Email

Preferred Contact Method: Email is preferred for contact. Please put "CSCE 4255" in the subject line.

Expected Response Time: During the week I will respond within 24 hours. During the weekend, response time may be longer

Course Description

4255. Programming Math and Physics for Games. 3 hours. Fundamentals of game math and physics for game development, including linear algebra, matrix math for graphics, quaternions, basic physics equations, game math and physics implementation, physics engines. Prerequisite(s) : CSCE 2110 with a grade of C or better.

Course Structure

Our course meets twice a week for 80-minute sessions and is primarily lecture-based. There are no recitations or labs. Class time is used to develop the mathematics and physics behind games and to work through how they are implemented: the techniques, the intents, and the reasoning behind them.

Hands-on work happens out of class. There are five programming assignments in which you implement the material we cover, from linear algebra and collision through rigid body physics and physics engines, and they carry most of the weight of your grade.

Please plan on spending three hours on work outside of class for each hour in class (scale based on your experience).

Instructor Welcome and Course Orientation

I am Jonathon Doran. My research is in procedural content generation for role-playing games. This course covers a different part of what makes a game feel real: the mathematics and physics that govern how things move, collide, and respond.

Games are simulations at heart. Under every jump arc, ragdoll, and ricochet there is linear algebra and mechanics running in real time on a

budget. Writing that code well takes more than calling a physics engine. You need to understand what the engine is doing so you can tell when it is lying to you.

A note on how this course works: your grade comes almost entirely from five programming assignments in which you implement the material yourself. My slides are talking points, not the course. This material sticks when you build it, and building it is exactly what the assignments ask you to do.

We do use the final exam slot, but for presentations rather than a test, and attendance at that session is required. Please do not schedule travel before our exam time which is listed in the calendar below.

Learning Outcomes and Alignment

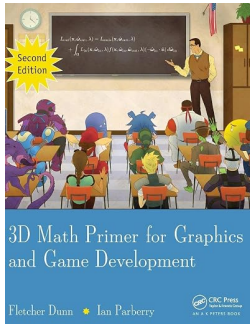
Course outcomes are measurable achievements to be accomplished by the completion of a course. These outcomes are evaluated as part of our ABET accreditation process. By the end of this course, you will be able to:

- 1. Apply linear algebra to problems in computer games and graphics.**
- 2. Apply geometric methods to problems in computer games and graphics, including collision detection.**
- 3. Analyze and solve problems involving bodies in motion using classical mechanics.**
- 4. Construct discrete implementations of continuous mathematical models using appropriate numerical methods.**
- 5. Write and test mathematics and physics code for computer games.**
- 6. Use a physics engine effectively, informed by an understanding of what it does on the program's behalf.**

Course Materials

None required

Recommended Materials



3D Math Primer for Graphics and Game Development
ISBN: 978-1568817231
Authors: Fletcher Dunn & Ian Parberry
Publisher: A K Peters/CRC Press
Publication Date: November 2011
Edition: 2nd

Course-Specific Technology

Access to a Windows 10 or 11 gaming PC is mandatory. Prior experience with Visual C++, DirectX12, and Git is useful but not required.

We will use Visual Studio, Box2D, Bullet, and a LARC library that performs basic collision tests. All of it is available at no cost. Some of this software is Windows specific. It might run on a Mac or a Linux box, and you are welcome to try, but Windows is the supported platform

Major Assignments and Assessments

Programming Assignments: There are five programming assignments across the semester. Each asks you to implement the mathematics or physics we have covered in class, and your submission is working source code, submitted through Canvas.

iClicker and Class Participation: iClicker questions are posed during lecture and answered in the moment. They are there to check understanding while the topic is still on the table, and they are part of how participation is assessed.

There are no examinations in this course.

Grading and Feedback

Area	Percentage of Final Grade
Programming Assignments	90%
iClicker and Class Participation	10%

Important: If you believe that there is a mistake in the grading of one of your assignments, you must bring these inquiries to the professor within one week of when the assignment is returned. After this period, it is too late to consider, except for an arithmetic error in calculating the score.

Note on code repository usage: Always submit code to our course's official GitLab project using your official UNT email. This is to ensure that you receive proper credit. It is your responsibility to review this information periodically and to ensure that your submissions are correct. Please ask for help if you run into trouble.

Course Calendar

Week	Week of	Major Topics	Due
0x1	17-August	Introduction, Linear Algebra	
0x2	24-August	Linear Algebra	
0x3	31-August	Blank Game, Collision	
0x4	7-September	Collision	Program 1
0x5	14-September	Collision, Quadtrees	
0x6	21-September	Rigid Body Physics	
0x7	28-September	Soft Body Physics	Program 2
0x8	5-October	Box2D, Three Modules	
0x9	12-October	Three Modules, 2D Joint Toy	
0xA	19-October	2D Joint Toy, Cannon Game	Program 3
0xB	26-October	Cannon Game, More Fun	
0xC	2-November	Bullet Physics Engine	
0xD	9-November	Rube Goldberg Machines, Line Drawing	Program 4
0xE	16-November	Kissing Numbers, Quaternions	
0xF	23-November	Thanksgiving Break (no class)	

Week	Week of	Major Topics	Due
0x10	30-November	TBA	Program 5
0x11	8-December 7:30am	Mandatory Presentations	

Assignment due dates are listed in Canvas; assignments are due at the end of the week shown. This schedule is subject to change. Changes will be announced in class and reflected here.

Authorized Absences Policy

An absence will be excused by the university for: a. religious holy day, including travel for that purpose; b. participation in an official university function; c. required military service, including travel for that purpose; d. pregnancy and parenting under Title IX; and e. when the University is officially closed.

For more details and procedures regarding UNT Authorized Absences, please see [Policy 06.039](#).

Absences that do not fall under Title IX, Required Military Service, and Official University Absences (religious holy days, participation in an official university function, and when the University is officially closed), are deemed a matter between the student and their faculty member. If the absence is due to an illness or extenuating circumstance that exceeds 5 consecutive days, the faculty member may request for the student to provide documentation through the Dean of Students' office.

Course Level Absence Practice

Notify me in advance whenever the situation allows, and as soon as possible when it does not. Religious holy days and university functions are known well ahead of time; tell me early in the semester rather than the week of.

For absences outside the university-authorized categories above, such as illness or another extenuating circumstance, I expect documentation from a relevant third party that identifies the dates involved.

Absence accommodations exist for situations that are genuinely unavoidable and could not reasonably have been scheduled around. Please schedule what you can schedule.

For an authorized absence, we will arrange a reasonable substitute for the missed work. For a decision brief, this generally means the credit is waived rather than made up.

If something is affecting your ability to complete work, raise it when it arises rather than at the end of the semester. Options that exist in Week 6 do not exist in Week 15.

UNT Academic Integrity Policy

According to [UNT Policy 06.003](#), Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University.

Course Specific Academic Integrity Practice

Using external code, assets, and tutorials is permitted and expected in this course; representing them as your own work is not. Cite what you used, in a code comment or in your report.

You are encouraged to discuss approaches, debug together, and explain techniques to each other. Writing code for another student, or submitting code you did not write and cannot explain, is not collaboration.

Your project repository is a record of your own work, and I look at commit history.

AI Use Practice

You may use generative AI in this course. I would rather you learn to use it well than pretend you are not using it.

Two things are non-negotiable. You are responsible for everything you submit, and you must be able to explain it. This is not a special rule for AI; it is the same standard applied to every assignment in this course. If you

cannot say what your code does and why you chose that approach, it does not matter where it came from.

Note briefly what you used AI for when you used it substantively. This is not punitive. It is what I would expect from a colleague.

Being a good user of these tools means knowing what they are good at, checking what they produce, and being able to tell when they are confidently wrong. That is a skill worth having, and this is a reasonable place to practice it.

I have built a custom GPT for this course, named Mentor, which you may find useful when you are stuck. Using it requires an OpenAI account (for all practical purposes); unfortunately there is no way around that.

Course Level Practices

Attendance is encouraged, and will not be taken after the University's mandatory period. You are responsible for everything covered in class, whether you were there or not. Note that iClicker participation happens during lecture, so missing class has a cost even without a roll sheet. The one session where attendance is required is the presentation session during finals week.

This is a lecture course, but it works better as a conversation. Answer the iClicker questions, ask your own, and do not be afraid to be wrong out loud; I would rather hear a half-formed answer than silence.

Late work will not in general be accepted. Exceptions can be made for unavoidable and unforeseen circumstances such as serious illness, family emergency, zombie apocalypse, or civil war. All requests for extensions must be made before the due date; after the due date, only truly compelling circumstances will be considered.

The programming assignments are individual work. You are welcome to

discuss approaches with classmates, but the code you submit must be your own.

Please communicate with your classmates and me the way you would with colleagues at a job you want to keep. Disagreement about technical matters is healthy and expected; disrespect is neither.

If you believe there is a mistake in the grading of an assignment, bring it to me within one week of the assignment being returned. After that, only arithmetic errors will be corrected.

Student Success Guidance

The programming assignments are spaced weeks apart, and that might lull you into a sense of complacency. The mathematics is usually not the hard part once you see it, but it might take a bit to get the code working right. Start each assignment when it is assigned, not the week it is due, so you hit the confusing part while there is still time to ask about it.

If your linear algebra is rusty, fix that in the first two weeks, not during the first assignment. The recommended text by Dunn and Parberry is a good refresher and a good reference all semester. I also recommend Gilbert Strang's MIT linear algebra lectures (18.06) on Youtube. He taught the subject for six decades before retiring, and it shows.

Feedback on each program is written to help you with the next one. If a comment is unclear, ask me what I meant. Feedback you do not read is work we both wasted.

A good question says what you were trying to do, what you tried, and where it stopped making sense. That question usually gets answered in five minutes. 'It doesn't work' takes an hour and often does not get resolved. This applies in office hours and email alike.

Do not be afraid to admit that you are stuck and need help. I am happy to look over what you have attempted and make recommendations. Avoiding

that conversation is one of the worst things you can do for yourself in the course.

Academic Support and Student Services

Technology Support

Part of working in the online environment involves managing the inconveniences and frustrations that can arise when technology breaks down or does not perform as expected. Here at UNT, we have a [Student Help Desk](#) that you can contact for help with Canvas or other technology issues:

- Phone: 940-565-2324
- Email: helpdesk@unt.edu
- Current list of [Student Help Desk hours](#)

Academic Support Services

- The [UNT Academic Resource Center](#) provides links to the bookstore, registration and advising information, tuition information, financial aid, and more.
- The [UNT Academic Success Center](#) offers academic support services and free individual tutoring.
- [UNT Writing Lab](#)
- [UNT Libraries](#)

Student Services

- [Counseling and Testing Services](#)
- [Student Affairs Care Team](#)
- [Student Health and Wellness Center](#)
- [Student Legal Services](#)
- [UNT Food Pantry](#)

Civil Discourse

As a leading public university, the University of North Texas has a fundamental responsibility to create enduring value for the public good. The fulfillment of our mission as a university depends upon the free exchange of ideas in the pursuit of knowledge. We bring these

commitments into action by centering civil discourse in our culture and curriculum. We define civil discourse as the practice of constructive dialogue to broaden understanding, grounded in our shared values and deep respect for each other's potential. By committing to this practice, we seek to equip every student with skills and mindsets to engage, contribute, and lead—at UNT and throughout your lives.

Engaging with different ideas, asking questions, and debating are essential to a university education. This course may include ideas you disagree with, find unwise, or even find offensive – that we include for purposes of academic inquiry and critical examination. You may be asked to demonstrate understanding of these ideas without being required to believe or endorse them. My role as an instructor is to help you build understanding and foster critical thinking. If any claim – mine, yours, or a fellow student's – seems unclear or unsupported, we should be able to ask each other to explain it. Vigorous debate is welcome. Speech that violates the Student Code of Conduct, including speech that harasses a specific individual or disrupts the course is not. You may expect that views expressed in class will not be attributed to specific individuals outside of class, and that you will be evaluated fairly based on the learning objectives of this course.

University Policies

ADA Accommodation Statement: UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one's specific course needs. Students may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the ODA website at disability.unt.edu.

Emergency Notification & Procedures: UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to the UNT Learning Management System (LMS) for contingency plans for covering course materials.

Retention of Student Records: Student records pertaining to this course are maintained in a secure location by the instructor of record. All records such as exams, answer sheets (with keys), and written papers submitted during the duration of the course are kept for at least one calendar year after course completion. Course work completed via the Blackboard online system, including grading information and comments, is also stored in a safe electronic environment for one year. Students have the right to view their individual record; however, information about student's records will not be divulged to other individuals without proper written consent. Students are encouraged to review the Public Information Policy and the Family Educational Rights and Privacy Act (FERPA) laws and the University's policy. See UNT Policy 10.10, Records Management and Retention for additional information.

Acceptable Student Behavior: Student behavior that interferes with an instructor's ability to conduct a class or other students' opportunity to learn is unacceptable and disruptive and will not be tolerated in any instructional forum at UNT. Students engaging in unacceptable behavior will be directed to leave the classroom and the instructor may refer the student to the Dean of Students to consider whether the student's conduct violated the Code of Student Conduct. The University's expectations for student conduct apply to all instructional forums, including University and electronic classroom, labs, discussion groups, field trips, etc. The Code of Student Conduct can be found at deanofstudents.unt.edu/conduct.

Access to Information – Eagle Connect: Students' access point for business and academic services at UNT is located at: my.unt.edu. All official communication from the University will be delivered to a student's

Eagle Connect account. For more information, please visit the website that explains Eagle Connect and how to forward e-mail: eagleconnect.unt.edu/.

Student Evaluation Administration Dates: Student feedback is important and an essential part of participation in this course. The student evaluation of instruction is a requirement for all organized classes at UNT. Students will receive an email from "UNT SPOT Course Evaluations via IASystem Notification" (no-reply@iasystem.org) with the survey link. Students should look for the email in their UNT email inbox. Simply click on the link and complete the survey. Once students complete the survey they will receive a confirmation email that the survey has been submitted. For additional information, please visit the SPOT website at spot.unt.edu or email spot@unt.edu.

Survivor Advocacy: UNT is committed to providing a safe learning environment free of all forms of sexual misconduct, including sexual harassment sexual assault, domestic violence, dating violence, and stalking. Federal laws (Title IX and the Violence Against Women Act) and UNT policies prohibit discrimination on the basis of sex, and therefore prohibit sexual misconduct. If you or someone you know is experiencing sexual harassment, relationship violence, stalking, and/or sexual assault, there are campus resources available to provide support and assistance. UNT's Survivor Advocates can assist a student who has been impacted by violence by filing protective orders, completing crime victim's compensation applications, contacting professors for absences related to an assault, working with housing to facilitate a room change where appropriate, and connecting students to other resources available both on and off campus. The Survivor Advocates can be reached at SurvivorAdvocate@unt.edu or by calling the Dean of Students Office at 940-565-2648. Additionally, alleged sexual misconduct can be non-confidentially reported to the Title IX Coordinator at oeo@unt.edu or at (940) 565 2759.

Pregnancy Modifications Under Title IX and Parenting Resources: UNT is committed to supporting students who may need pregnancy and parenting

modifications in compliance with Title IX. If you are a pregnant student or have a pregnancy related condition, please visit report.unt.edu and complete the 'Request Pregnancy/Parenting Modifications' form. Parenting students who may need resources can seek support and guidance from the Dean of Students and the Eagle Engagement Center. [Pregnant and Parenting Students Policy number 16.008](#).

Copyright Notice: Materials used in connection with this course may be subject to copyright protection. Materials may include, but are not limited to: documents, slides, images, audio, and video. Materials in this course website are only for the use of students enrolled in this course, for purposes associated with this course, and may not be retained for longer than the class term. Unauthorized retention, duplication, distribution, or modification of copyrighted materials is strictly prohibited by law. For more information, visit the [UNT Policy Office](#), or Copyright.gov.

Web Accessibility & Privacy: Please find the web accessibility and privacy statements for UNT and Canvas.

UNT

- [Web Accessibility Policy](#)
- [Privacy Statement](#)

Canvas/Instructor

- [Accessibility Statement](#)
[Privacy Policy](#)