CSci 191t

Game Development

Tu/Th, 9:00-10:15AM, Sci II 231

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This syllabus and schedule are subject to change in the event of extenuating circumstances. If you are absent from class, it is your responsibility to check on announcements made while you were absent.

Course Description: Computer graphics, linear algebra, Implementation issues, dynamics, performance issues, multiplayer and networking issues, and advanced topics (as time and interest permit)

Prerequisite(s): CSci 115 (may be taken concurrently)
Units: 3
Text(s): None

Course Topics

We will (try) to cover, roughly in chronological order:

1. Dynamics: equations of motion, numerical integration methods, collision detection and response.

2. Computer graphics: framebuffers and bitmaps, color representation, compositing equations, Bresenham's algorithms.

3. Linear algebra: vectors and matrix operations, coordinate transforms.

4. Implementation issues: entity and world-state representation, input processing, timing

5. Performance issues: locality of reference, space/time complexity, performance of allocation/deallocation and garbage collection schemes, object pools, spacial hashing and quad/oct-tree representations.

6. Multiplayer and networking issues: latency and latency compensation, motion prediction, world-state compression, lossy communications, peer-to-peer vs. client-server architectures, anti-cheating measures.

7. Advanced topics (as time/interest permits): 3D graphics and audio, virtual reality, multithreading, general-purpose GPU computation, procedural content generation, AI for games.

Course Goals

The goal of this course is to give students a good foundation for game development work, whether based on the current leading game development frameworks (Unity, UE4, etc.) or future frameworks which have not yet been developed. To this end, we will pursue a "bottom up" approach, beginning with fundamentals and working our way up to higher-level issues.

Learning objectives

At the conclusion of this course, students are expected to be able to

- Implement the basic algorithms of computer graphics: line, circle, and shape drawing; image and color compositing.

- Implement a time-discrete simulation for the basic equations of motion: acceleration, velocity, position, objects with mass, gravity, friction, forces, and simple collisions with conservation of momentum and kinetic energy.

- Use 2- and 3-D vectors and matrices and the corresponding linear algebra to simplify manipulation of vector quantities.

- Explain the various issues surrounding performance in a near-real-time system.

- Explain the problems raised by distributing world-state over multiple machines, as in a multiplayer architecture, and describe some solutions.

Grade distribution

Participation	10%
Assignments	10%
Project presentation	20%
Project content	40%
Final Exam	20%

This class is largely *project oriented*; the majority of your grade will come from the actual content of your project, as well as from two project presentation periods we will have. We will have a "project checkin", roughly in the middle of the semester, as an opportunity for you to show me and the rest of the class your progress, and then final project presentations at the end of the semester.

You may work on your projects in teams of up to four people (self-selected), however, my evaluation of your project will be weighted by the size of your team! Larger teams are expected to be able to accomplish more than individuals working alone. We will discuss what kinds of projects are appropriate on the first day of class.

Small assignments will be occasionally assigned to test your knowledge of particularly important material.

The final exam will be open book, open notes, open computer. It will consist of a mixture of multiple choice and short written-answer questions. Note that any arrangements for rescheduling the final exam *must* be made in advance; except for extraordinary circumstances, no makeups will be allowed. Missing the final exam may result in a grade of WU (unauthorized withdrawal), which, while counting as a F for GPA purposes, may also affect your ability to receive financial aid. Also note that university policy forbids rescheduling a final exam to *earlier* than its regular time and date, without a strongly compelling reason.

Letter Grade Distribution

$\geq$ 90.00%	A
80.00 – 89.99	B
70.00 – 79.99	C
60.00 – 69.99	D
$\leq$ 59.99	F

A class-wide adjustment may be applied, in the event of extenuating circumstances (e.g., assignments more or less difficult than anticipated).

Course Policies

- This course does not have a textbook. Instead, I'll be assembling notes from various sources. You are welcome to augment the "official" information with any other sources you find useful (and you are encouraged to share with the rest of the class).

University Policies

Students with Disabilities: Upon identifying themselves to the instructor and the university, students with disabilities will receive reasonable accommodation for learning and evaluation. For more information, contact Services to Students with Disabilities in the Henry Madden Library, Room 1202 (278-2811).

Honor Code: "Members of the CSU Fresno academic community adhere to principles of academic integrity and mutual respect while engaged in university work and related activities."

Cheating and Plagiarism: "Cheating is the actual or attempted practice of fraudulent or deceptive acts for the purpose of improving one's grade or obtaining course credit; such acts also include assisting another student to do so. Typically, such acts occur in relation to examinations. However, it is the intent of this definition that the term 'cheating' not be limited to examination situations only, but that it include any and all actions by a student that are intended to gain an unearned academic advantage by fraudulent or deceptive means. Plagiarism is a specific form of cheating which consists of the misuse of the published and/or unpublished works of others by misrepresenting the material (i.e., their intellectual property) so used as one's own work." Penalties for cheating and plagiarism range from a 0 or F on a particular assignment, through an F for the course, to expulsion from the university.

Computers: "At California State University, Fresno, computers and communications links to remote resources are recognized as being integral to the education and research experience. Every student is required to have his/her own computer or have other personal access to a workstation (including a modem and a printer) with all the recommended software. In the curriculum and class assignments, students are presumed to have 24-hour access to a computer workstation and the necessary communication links to the University's information resources."

Disruptive Classroom Behavior: "The classroom is a special environment in which students and faculty come together to promote learning and growth. It is essential to this learning environment that respect for the rights of others seeking to learn, respect for the professionalism of the instructor, and the general goals of academic freedom are maintained. ... Differences of viewpoint or concerns should be expressed in terms which are supportive of the learning process, creating an environment in which students and faculty may learn to reason with clarity and compassion, to share of themselves without losing their identities, and to develop and understanding of the community in which they live ... Student conduct which disrupts the learning process shall not be tolerated and may lead to disciplinary action and/or removal from class."

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The California Faculty Association is in the midst of a difficult contract dispute with management. It is possible that the faculty union will call a strike or other work stoppage this term. I will inform the class as soon as possible of any disruption to the posted schedule.

Tentative course calendar

- Weeks 1-3: Broad topical overview

- **Feb 6**: Project proposals (with team memberships) due

- Weeks 4-6: Dynamics, equations of motion, numerical methods

- Weeks 6-8: Graphics: representation and algorithms, linear algebra (as needed)

- Week 9: Linear algebra

- **Mar. 21-25**: Spring recess

- Week 11: Project checkin presentations

- Week 12: Performance and architectural concerns

- Week 13, 14: Multiplayer, networking, and multithreading

- Week 15, 16: Advanced topics, based on class interest

- Week 17: Final project presentations

Finals Week:	May 16-19
Consultation Days:	May 12, 13
Final Exam:	**Tuesday, May 17, 8:45AM**