GDD 175. Advanced Techniques in Game Development

Credit hours: 3 Credits
Term: Spring 2020
Meeting time: Friday 2:00 – 4:30 pm
Location: Tator Hall, Room 129

Instructor: Dr. Greg Luther (Gregory.luther@qu.edu)

Office Hours: 1 – 2 or by appointment. I am available during the week (Monday – Friday). I will try to respond to email within 48 hours of receiving it.

Class website: http://mywebspace.quinnipiac.edu/ggluther/GDD175_SP2020
Class resources: The course material is not available in one text. References and links are provided on the class website.

COURSE DESCRIPTION

Modern games rely on advanced game engine components to generate compelling dynamic game mechanics. This course takes a deeper look at the mathematical techniques and algorithms that make up these core game engine components. In it the game engine architecture, 3D game geometry and the rendering pipeline will be reviewed. To simulate realistic dynamics, core ideas in game physics will be developed through the understanding of forces and collisions that enable particle and rigid-body representations of game objects to move and interact. Techniques for procedural generation, artificial intelligence, and game analytics will be developed.

Throughout the course, these topics will be developed by evaluating a number of important game examples that leverage widely used and understood game techniques. Each example will be studied from three basic vantage points. The background mathematical, physical and algorithmic ideas will be developed. They will be tied directly to their implementation in object-oriented code. Each implementation will be analyzed and tested to understand tradeoffs in the use of computational and memory resources and their scaling.

LEARNING OBJECTIVES

a. Understand game engine structure and key components
b. Develop skills to use and augment advanced game engine features
c. Develop core mathematics, physics and algorithmic skills that enable game engines
d. Build capability to analyze and test implementation performance
e. Broaden awareness and understanding of advanced tools and techniques
f. Develop professional communication and project skills
g. Provide a baseline for further study of advanced topics following the course

PHILOSOPHY

Game developers typically work in teams utilizing well-developed game engines. In this course we investigate how the core elements of game engines work, and we will begin to develop skills to analyze game engine performance.

SCHEDULE

Below is an outline of the content of the course. The basic structure will remain, but the order and depth may change as we work through the topics.

Week 1: Class introduction, game engine architectures and functions, rendering pipeline, 3D geometry and game mathematics
Week 2: 3D geometry and game mathematics continued
Week 3: Game physics and particle motion
Week 4: Game physics with forces and aggregate particle motion
Week 5: Game physics with rigid bodies (rotations, collisions and constraints)
Week 6: Rendering, meshes and graphics primitives
Week 7: Procedural generation of complex scenes and fluids
Week 8: Game artificial intelligence and agents
Week 9: Game artificial intelligence: state machines and path planning
Week 11: Spring break
Week 12: Game Analytics and data science for games
Week 13: University Holiday no class
Week 14: Game Analytics and data science for games
Week 15: Course summary and review
Week 16: Course summary and term project
Week 17: Final project presentations

WEBSITES

In addition to turning work in on Blackboard, students will post all assignments to their website on mywebspace. Please make a GDD175 folder with an index page that links to your assignments. You can also publish your work to your portfolio and link to it from your index page.

TEAMS

All classmates will likely be working on teams. Team management is a critically important skill in the game industry. How you behave on your team, and how you manage issues that arise will greatly impact your success in the class and on your project.

STORAGE

GDD is a program in which you will be generating a great deal of digital content. Safe storage of this material is essential to your success in the GDD program.

You should use your allocated space on OneDrive where you can store your materials, but it is essential that you also have your own external drive in which you keep current and backup files for all of your work. Do not leave materials on the hard drives of the machines in the lab as these machines can crash or have the drives wiped unpredictably. As professionals in this field we expect you to understand that lost or damaged files are not an excuse for missing or late work. Backup your work and archive it regularly. Use Git for all code.

STUDENT WORK

GDD keeps an archive of student work which may be displayed on the program website and used to publicize and promote our students and our program. At the end of each semester, you are responsible for turning in (on OneDrive) your completed projects in playable form, with all associated code and media, to your professor. You should also turn in a video of gameplay. Make sure you and any other sources are accurately credited in these materials. You should also have a website that GDD will link to from the student page of the GDD site that provides links to your bio and completed projects.

No eating in the lab. No cellphone use during class time. No working on projects, browsing the web or watching YouTube while other students are making presentations or during class discussions. This extremely disrespectful towards your classmates and will negatively impact your grade.

ASSIGNMENTS and GRADING RUBRIC

40% Labs (80 points each x 5 = 400pts)

20% Quizzes (40 points each x 5 = 200pts)

35% Term Project (80% process, 20% game)

5% Professionalism

If you do not show up for your final presentation for a group project without notifying me prior, you will fail the project. This often means failing the class.

Labs will be graded on the following scale:

100(A) You went above and beyond the assignment, demonstrating deep engagement with the subject matter.

85(B) You completed the assignment and posted it before the due date.

60(D) You posted your lab before the due date, but didn't complete the

assignment.

0(F) You didn't post your lab before the due date.

All assignment and project grades will use the following scale:

100(A) Excellent work. You went above and beyond the assignment, demonstrating deep engagement with the subject matter. Professional quality.

89(B+) Great work. You demonstrate basic mastery of the subject matter.

82(B-) Good work. You understand the subject matter and demonstrate proficiency. The work is solid, but not original or creative.

76(C) Satisfactory work. Your work shows understanding of basic concepts but has occasional lapses.

69(D) Poor work. Barely adequate. Shows major gaps in understanding.

59(F) Unsatisfactory. Does not satisfy the learning requirement

Nothing. You didn't hand in or show your work before the due date

GRADES

It is your responsibility to keep track of your grades throughout the semester. Grades will be posted on Blackboard and may be checked at any time. If you are not doing as well as you would like to be, you can meet with me to discuss extra credit projects BEFORE the semester ends. If you feel that I have made a mistake recording a grade or failed to enter a grade that you earned correctly, please email me so that I can correct it. Do not contact me just because you want a higher grade on a graded assignment.

ACADEMIC INTEGRITY

All the work you do for class must be your own unless you cite it. Clearly provide links to any code, art, music, or sound you used to complete assignments. This is especially important regarding the use of tutorials. If you use a tutorial from the web that includes code, I expect you to be able to explain how each line of code works, notify me that you are using a tutorial and provide a link to that tutorial. If you do not do this or fail to cite your sources, it will be assumed that you are trying to pass off the work as your own and it will be considered plagiarism. This will result in a zero on the assignment, notifying the Academic Integrity Board and a permanent record in your file

At Quinnipiac, our community has chosen integrity as one of its guiding principles. Our academic integrity policy is based on the five fundamental values outlined by the Center for Academic Integrity: honesty, trust, responsibility, fairness and respect. "Double Dipping" (Multiple Uses of the Same Work) or presenting the same or substantially the same written work (or portion thereof) as part of the course requirement for more than one project or course, requires the express prior written permission of the instructor(s) involved. Any violation will be dealt with according to the Integrity policy, which can be found here.

Student Handbook: The Quinnipiac University Student Handbook is intended to serve as a source of information on the many services, activities and policies of Quinnipiac. The handbook can be found here

GRADING SCALE

Your final letter grade is based on the Quinnipiac Grading Scale as follows:

A 93–100	B+ 87–89	B- 80–82	C 73–76	D 60–69
A- 90–92	B 83–86	C+ 77–79	C- 70–72	F 0–59

NOTE: A C- or better is required in all departmental prerequisites

VPA ATTENDANCE POLICY

You are expected to be in class ready to work at the beginning of the scheduled class time. PROMPT ARRIVAL TO CLASS IS EXPECTED. Three late arrivals to class will equal one absence. PLEASE NOTE: IF YOU HAVE 6 OR MORE ABSENCES YOU MAY BE ASKED TO WITHDRAW FROM THE COURSE. 7 ABSENCES DURING THE SEMESTER WILL RESULT IN A FAILING GRADE. Attendance for the last class meeting scheduled during Finals Week is required.

There is no distinction between "excused" or "unexcused" absences - missed course work, content and class participation are an issue in any absence and can negatively impact the rest of the class members. In the case of extenuating circumstances, such as an ongoing illness or the death of a loved one, the

professor should be consulted as soon as possible, and documentation from the Student Affairs office may be required. In such circumstances the faculty and student can negotiate the possibility of granting an "Incomplete." In the rare cases where a student is allowed to take an "Incomplete" as the result of extenuating circumstances, the student must follow the guidelines and timelines stipulated in the University catalog.

VPA LATE WORK POLICY

The assignments for this class must be turned in complete and on-time. NO LATE WORK IS ACCEPTED. If you have a medical or family emergency which will prevent you from getting your work done, it is your obligation to notify the professor of this fact and provide him/her with the appropriate documentation BEFORE the due date of the assignment. If your work is not turned in on time and you have not provided an excuse prior to the due date, do NOT email the professor with justifications. You will simply not receive credit for the assignment.

POLICY ON DISABILITIES

Students with disabilities who wish to request reasonable accommodations should contact the Office of Student Accessibility in Arnold Bernhard Library north wing at (203) 582-7600 or North Haven at SLE 340 (203)-582-7600 (access@quinnnipiac.edu). Quinnipiac University complies with the Americans with Disabilities Act and Section 504 of the Rehabilitation Act.

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http://www.quinnipiac.edu/student-experience/health-and-safety/student- handbook/

LEARNING COMMONS

The Learning Commons is a place for students to go when they want to achieve a level of performance they can't reach on their own. In a setting of practice and growth, student resources are provided through Peer Educator programs, the Office of Student Accessibility, and Academic Development & Outreach professional staff. The Learning Commons can be found at the Mount Carmel Campus in the North wing of the Arnold Bernhard Library; and at the North Haven Campus on the third floor of the Law School (SLE-340). Students are encouraged to visit The Learning Commons for support with class content, to improve study skills, to consult on academic success strategies, and for general developmental advising needs.

Phone: 203-582-8628
Email: LearningCommons@Quinnipiac.edu
Website: https://www.qu.edu/student-resources/academic-support.html