



Northeastern University

College of Engineering

CSYE 7270

Building Virtual Environments

Course Information

Building Virtual Environments

CSYE 7270

Summer 2020

4 Credit Hours

Location (*100% online through BB Collab*)

Instructor Information

Professor: Nik Bear Brown

Email: ni.brown@neu.edu

Office: 505A Dana Hall

TA

Rui Xia <xia.r@northeastern.edu>

Technical/Course Materials Requirements

Readings to be given weekly in class.

Need laptop or access to a computer.

You need to download and install the free and open-source Unreal Engine <https://www.unrealengine.com/en-US/>

The textbooks are all available for free to NEU students via SpringerLink (<http://link.springer.com/>).

[BUGD] Beginning Unreal Game Development - Foundation for Simple to Complex Games Using Unreal Engine 4 by David Nixon The book is free at <https://link.springer.com/book/10.1007/978-1-4842-5639-8> when logged in through a Northeastern network.

The course GitHub (for all lectures, assignments and projects):

https://github.com/nikbearbrown/CSYE_7270

nikbearbrown YouTube channel

Over the course of the semester I'll be making and putting additional data science and machine learning related video's on my YouTube channel.

<https://www.youtube.com/user/nikbearbrown>

Slack

Join the Slack -

https://join.slack.com/t/neuaskunkworks/shared_invite/enQtNzQyNDg1MjgzNjM0LTYxMWRhMWVlMWIxMzUxMTg0YjI4YTQ2NTQyOWM1MmNkOThkYWl0MWU4Y2MyZjA2Njg2Y2Y0YjRjNjQwNWY3MDk

Then join channel #csye_7270

Course Description

This course examines how to program for virtual environments in Unreal Engine. Introduces the different subsystems used to create 2D and 3D worlds, including rendering, animation, collision, physics, audio, trigger systems, shading, game logic, behavior trees, and simple artificial intelligence. Offers students an opportunity to learn the inner workings of game and graphics engines and how to use libraries such as physics and graphics libraries to develop virtual environments. Discusses graphics pipeline, scene graph, level design, behavior scripting, object-oriented game design, world editors, and scripting languages. Includes servers and mobile programming (Android and iPhone) will also be introduced.

- There will be weekly assignments creating small games or tools or virtual environments.
- There will be biweekly in-class progress presentations.
- There will be a group project and an individual project.

The first half of the class will primarily involve the mechanics of programming for program for games and virtual environments in Unreal Engine by building a series of small projects. Students will be given a simple skeleton and then expected to enhance/extend the skeleton for each assignment.

The second half of the class will primarily involve social/network gaming, virtual reality and augmented reality programming.

Course Prerequisite

Some programming experience.

Student Learning/Course Outcomes (SLOs)

Learning objectives for the course are:

- Learn how to program in C++ and C# in a clear, robust, efficient, and safe manner.
- Unreal Engine rendering
- Animation
- Unreal Engine collisions
- Unreal Engine physics
- Unreal Engine audio
- Unreal Engine trigger systems
- Unreal Engine shaders
- Augmented reality
- Virtual reality
- Social/network gaming
- Mobile gaming
- Game servers
- Basic Game AI
- Basic Game Analytics

Attendance Policy

Participation in discussions is an important aspect on the class. It is important that both students and instructional staff help foster an environment in which students feel safe asking questions, posing their opinions, and sharing their work for critique. If at any time you feel this environment is being threatened—by other students, the TA, or the professor—speak up and make your concerns heard. If you feel uncomfortable broaching this topic with the professor, you should feel free to voice your concerns to the Dean's office. Students are expected to complete course readings, participate in class discussions or other learning activities during the unit, and complete written assignments for each unit during the time of that unit.

It is understood that there might be one week when active participation in ongoing class conversations and learning activities might be delayed. Beyond one week time, if there is an absence or lateness in participation (1) faculty must be notified in advance; (2) grades will be adjusted accordingly.

Collaboration Policy

Students are strongly encouraged to collaborate through discussing strategies for completing assignments, talking about the readings before class, and studying for the exams. However, all work that you turn in to me with your name on it must be in your own words or coded in your own style. Directly copied code or text from any other source MUST be cited. In any case, you must write up your solutions, in your own words. Furthermore, if you did collaborate on any problem, you must clearly list all of the collaborators in your submission. Handing in the same work for more than one course without explicit permission is forbidden.

Feel free to discuss general strategies, but any written work or code should be your own, in your own words/style. If you have collaborated on ideas leading up to the final solution, give each other credit on what you turn in, clearly labeling who contributed what ideas. Individuals should be able to explain the function of every aspect of group-produced work. Not understanding what plagiarism is does not constitute an excuse for committing it. You should familiarize yourself with the University's policies on academic dishonesty at the beginning of the semester. If you have any doubts whatsoever about whether you are breaking the rules – ask!

Any submitted work violating the collaboration policies WILL BE GIVEN A ZERO even if “by mistake.” Multiple mistakes will be sent to OSCCR for disciplinary review.

To reiterate: plagiarism and cheating are strictly forbidden. No excuses, no exceptions. All incidents of plagiarism and cheating will be sent to OSCCR for disciplinary review.

Late Work Policy

Students must submit assignments by the deadline in the time zone noted on BlackBoard. Students must communicate with the faculty prior to the deadline if they anticipate work will be submitted late.

Work submitted late without prior communication with faculty will be deducted 10% for each day late.

Grading/Evaluation Standards

Students are evaluated based on their performance on assignments, performance on exams, and both the execution and presentation of a final project. If a particular grade is required in this class to satisfy any external

criteria—including, but not limited to, employment opportunities, visa maintenance, scholarships, and financial aid—it is the student’s responsibility to earn that grade by working consistently throughout the semester. Grades will not be changed based on student need, nor will extra credit opportunities be provided to an individual student without being made available to the entire class.

Grade Scale

The following breakdown will be used for determining the final course grade:

Assignment	Percent of Total Grade
Assignments	30%
Mid-term Project	10%
Final Project	15%
Participation	15%
Portfolio	5%
Quizzes (In class)	10%
Exams (In class)	15%

* Note that the assignments, presentations and drafts related to the research project go to that score rather than the programming assignments. I expect to use the following grading scale at the end of the semester. You should not expect a curve to be applied; but I reserve the right to use one.

Score	Grade
93 – 100	A
90 – 92	A-
88 – 89	B+
83 – 87	B
80 – 82	B-
78 – 79	C+
73 – 77	C
70 – 72	C-
60 – 69	D
<60	F

Scores in-between grades. For example, 82.5 or 92.3 will be decided based on the exams.

* Note the score is calculated using the grading rubric and IS NOT the average of the assignments that is displayed by BlackBoard.

Achievement of learning outcomes will be assessed and graded through:

- Quizzes
- Exams
- Completion of assignments involving scripting in R or python, and analysis of data
- Completion of a term paper asking and answering a “real world” question of interest using machine learning techniques
- Portfolio piece

Course Schedule

Week	Topic	Reading from BUGD/Github
One	C# and Unity	Github Week1
Two	C++ and Unreal	Github Week2
Three	The Level Editor , Actors , Game Design	Pages 21-71 Pages 73-113 Github Week3
Four	Blueprints , Players and Input	Pages 115-164 Pages 165-189
Five	Collisions , Physics	Pages 191-207
Six	Audio , Animation User Interfaces	Pages 247-270 Pages 209-245
Seven	Shaders	Github Week7
Eight	Game AI basics	Github Week8
Nine	Game Analytics basics	Github Week9
Ten	Mobile Games	Github Week10
Eleven	VR Games	Github Week11

Academic Integrity

A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University.

As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in this Code or by the direction of instructors.

Go to <http://www.northeastern.edu/osccr/academic-integrity-policy/> to access the full academic integrity policy.

Student Accommodations

Northeastern University and the Disability Resource Center (DRC) are committed to providing disability services that enable students who qualify under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act Amendments Act (ADAAA) to participate fully in the activities of the university. To receive accommodations through the DRC, students must provide appropriate documentation that demonstrates a current substantially limiting disability.

For more information, visit <http://www.northeastern.edu/drc/getting-started-with-the-drc/>.

Library Services

The Northeastern University Library is at the hub of campus intellectual life. Resources include over 900,000 print volumes, 206,500 e-books, and 70,225 electronic journals.

For more information and for Education specific resources, visit <http://subjectguides.lib.neu.edu/edresearch>.

Diversity and Inclusion

Northeastern University is committed to equal opportunity, affirmative action, diversity and social justice while building a climate of inclusion on and beyond campus. In the classroom, member of the University community work to cultivate an inclusive environment that denounces discrimination through innovation, collaboration and an awareness of global perspectives on social justice.

Please visit <http://www.northeastern.edu/oidi/> for complete information on Diversity and Inclusion

TITLE IX

Title IX of the Education Amendments of 1972 protects individuals from sex or gender-based discrimination, including discrimination based on gender-identity, in educational programs and activities that receive federal financial assistance.

Northeastern's Title IX Policy prohibits Prohibited Offenses, which are defined as sexual harassment, sexual assault, relationship or domestic violence, and stalking. The Title IX Policy applies to the entire community, including male, female, transgender students, faculty and staff.

In case of an emergency, please call 911.

Please visit www.northeastern.edu/titleix for a complete list of reporting options and resources both on- and off-campus.