CSC 481 Course Syllabus

CSC 481 - Game Engine Foundations
Section 001
FALL 2015
3 Credit Hours

Course Description

The purpose of this course is to familiarize students with issues and techniques of computer games design in general, and more specifically game engine design. With the proliferation of computer games, a number of distinct genres have emerged. Each genre of computer game provides a unique set of design challenges for designers. While there are no "one size fits all" solutions to game design problems, there are a number of techniques common to many different games. These commonalities have given rise to game engines which are software tools to aid designers. Behind almost all successful commercial games are a game engine.

In this course we will examine some of the components of a commercial strength game engine. We will survey different genres of games, using some of the unique design challenges each genre provides as a motivation for an in-depth examination of the affordances games engines provide for designing games of that genre. We will cover topics ranging from data structures, resource management, game loops and logical timing systems, scripting, error logging, and networking.

Students will be given a sequence of multi-week homework assignments, or mini-projects, related to the lecture material. These assignments will require students to implement and/or evaluate some of the algorithms or techniques we are covering during course lectures. Each assignment will build upon previous assignments, and by the end of the course students will have implemented a limited functionality game engine of their own. All students will additionally be evaluated with a midterm and a final exam.

Learning Outcomes

Students will:

1. develop a conceptual framework and vocabulary for computer game engines, their components, and designs as well as an understanding the role of a game engine in the game design process.
2. identify the different game engine systems, how they interact with each other, how they enable the design of various genres of computer games, and how they enable game engine reuse across games and/or game genres.
3. implement various engine systems, and combine them into a functional, simple game engine with sufficient capabilities to support the design of a game.
Course Structure

This will be a lecture course covering topics in computer game design and game engine design. Students will be given a sequence of multi-week homework assignments throughout the semester. Additionally, there will be a midterm and a final exam.

Course Policies

Homework:

Students will submit homework individually unless otherwise specified in the assignment (see the section on "Academic Integrity"). The assignments will either be posted on the course webpage, posted on the course moodle page, or distributed in class. If a student is unable to attend class, it is their responsibility to determine if an assignment was given. Unless otherwise indicated, all assignments will be due by the start of class on the date they are due, and must be submitted using the course moodle page. If assignment due dates fall on days when there is no class meeting, the assignment will be due at the time class meetings typically start.

Homework Grading:

Homework submissions will be graded according to the criteria outlined in the assignment. Missing components or lateness will be penalized accordingly.

Exams:

This course will have two exams: a midterm and a final. The midterm will be given in class on 10/15/15. The final exam is scheduled from 1:00pm - 4:00pm on 12/10/15. Note, the date of the midterm is subject to change at the discretion of the instructor.

Instructors

Dr David L Roberts (dilober4) - Instructor
Email: robertsd@csc.ncsu.edu  
Web Page: [http://www.csc.ncsu.edu/faculty/robertsd/](http://www.csc.ncsu.edu/faculty/robertsd/)

**Office Location:** EB2 2278. Please note: my office is scheduled to change from EB2 to Venture 2 near the beginning of the semester. Please ensure you confirm where office hours will be held before coming.

**Office Hours:** Mondays and Tuesdays 11am-12pm, and by appointment. My door is generally always open and you are welcome to stop by my office at other times, but I reserve the right not to meet with you even if I'm there.

**Mingyang Xu** (mxu5) - *Teaching Assistant*  
Email: mxu5@ncsu.edu  
Phone: None  
**Office Location:** Engineering Building II (EB2)  
**Office Hours:** TBD (check course website), and by appointment.

### Course Meetings

<table>
<thead>
<tr>
<th>Lecture</th>
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| **Days:** TH  
**Time:** 3:50pm - 5:05pm  
**Campus:** Centennial  
**Location:** Engineering Building 1 (EB1) room 1005  
This meeting is required. |

### Course Materials

<table>
<thead>
<tr>
<th>Textbooks</th>
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| **Game Engine Architecture** - Jason Gregory  
**Edition:** 2nd  
**ISBN:** 1568814135  
**Cost:** $55.60  
This textbook is optional. |

<table>
<thead>
<tr>
<th>Expenses</th>
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</table>
| **Blue books for exams**. - Approximately $0.50  
This expense is required. |

### Requisites and Restrictions

<table>
<thead>
<tr>
<th>Prerequisites</th>
<th>CSC 316</th>
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<table>
<thead>
<tr>
<th>Co-requisites</th>
<th>None</th>
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<table>
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<tr>
<th>Restrictions</th>
<th>CSC Majors only</th>
</tr>
</thead>
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### General Education Program (GEP) Information

<table>
<thead>
<tr>
<th>GEP Category</th>
<th>This course does not fulfill a General Education Program category.</th>
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| GEP Co-requisites | This course does not fulfill a General Education Program co-requisite. |
Transportation
This course will not require students to provide their own transportation. Non-scheduled class time for field trips or out-of-class activities is NOT required for this class.

Safety & Risk Assumptions
None.

Grading

<table>
<thead>
<tr>
<th>Grade Components</th>
<th>Weight</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homeworks</td>
<td>50%</td>
<td>There will be four homework assignments of equal weight throughout the semester.</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>20%</td>
<td>The midterm exam will be given in class on 10/15/15. The date is subject to change at the discretion of the instructor.</td>
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<tr>
<td>Final Exam</td>
<td>30%</td>
<td>The final will be cumulative, and given during the scheduled exam period from 1:00pm - 4:00pm on 12/10/15.</td>
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Letter Grades
This Course uses Standard NCSU Letter Grading Scale

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<thead>
<tr>
<th>Grade</th>
<th>Minimum Score</th>
<th>Maximum Score</th>
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<tbody>
<tr>
<td>A+</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>A</td>
<td>93</td>
<td>97</td>
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<td>C+</td>
<td>77</td>
<td>80</td>
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<td>77</td>
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<tr>
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Requirements for Credit-Only (S/U) Grading
In order to receive a grade of S, students are required to take all exams and quizzes, complete all assignments, and earn a grade of C- or better. Conversion from letter grading to credit only (S/U) grading is subject to university deadlines. Refer to the Registration and Records calendar for deadlines related to grading. For more details refer to http://policies.ncsu.edu/regulation/reg-02-20-15.

Requirements for Auditors (AU)
Information about and requirements for auditing a course can be found at http://policies.ncsu.edu/regulation/reg-02-20-04.

Policies on Incomplete Grades
If an extended deadline is not authorized by the instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) the end of 12 months if the student is not
enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at http://policies.ncsu.edu/regulation/reg-02-50-3.

**Late Assignments**

Unless otherwise requested, completed assignments should be turned in by the beginning of the class period on the date they are due. For assignments for which email or other electronic submission is requested, the submission should be completed before the start of the class period on the date they are due. Every student has four days which they may allocate to late assignments throughout the semester at a cost of five points per day. Once the allotment of four days has been used, there will be no more late submissions accepted. Use of late days is **not** pro rated. For example, a student who submits the first assignment two days, 8 hours, and 24 minutes late will receive 15 points off of their grade, and only has one day remaining for all subsequent assignments.

Valid excuses such as illnesses with a note from a doctor or a death in the family (with documentation) will be granted extensions to deadlines, provided the documentation is presented to the instructor in a timely manner. Other extensions may be granted for other scholarly activities provided arrangements are made with the instructor **well in advance** of the deadline.

**Attendance Policy**

For complete attendance and excused absence policies, please see http://policies.ncsu.edu/regulation/reg-02-20-03.

**Attendance Policy**

Attendance at class sessions is not required; however, absences that are unexcused according to the university's excused absence policy (http://policies.ncsu.edu/regulation/reg-02-20-03) and that result in late assignments or missed announcements may negatively affect students' grades. Documented medical excuses or other excused absences will not adversely affect grades. Conference travel or other scholarly duties discussed well in advance of a missed session may be excused at the discretion of the instructor.

**Absences Policy**

While attendance is not required at class sessions, the university's excused absence policy (http://policies.ncsu.edu/regulation/reg-02-20-03) will be used to determine when assignments are considered late or not.

**Makeup Work Policy**

There will be no makeup work given for unexcused missed assignments.

**Additional Excuses Policy**

None.

**Academic Integrity**
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Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at [http://policies.ncsu.edu/policy/pol-11-35-01](http://policies.ncsu.edu/policy/pol-11-35-01).

None.

**Academic Honesty**
See [http://policies.ncsu.edu/policy/pol-11-35-01](http://policies.ncsu.edu/policy/pol-11-35-01) for a detailed explanation of academic honesty.

None.

**Honor Pledge**
Your signature on any test or assignment indicates you "have neither given nor received unauthorized aid on this test or assignment." Additionally, by uploading an assignment to the course moodle page, you are certifying that you "have neither given nor received unauthorized aid on this test or assignment." Note, it is your responsibility to keep your passwords private and limit access to your moodle account.

**Electronically-Hosted Course Components**
Students may be required to disclose personally identifiable information to other students in the course, via electronic tools like email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

**Electronically-hosted Components**: Moodle will be used for supplementary course discussions and assignment submissions.

**Accommodations for Disabilities**
Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, student must register with the Disability Services Office ([http://www.ncsu.edu/dso](http://www.ncsu.edu/dso)), 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation at [http://policies.ncsu.edu/ regulation/reg-02-20-01](http://policies.ncsu.edu/regulation/reg-02-20-01).

**Non-Discrimination Policy**
NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at [http://policies.ncsu.edu/policy/pol-04-25-05](http://policies.ncsu.edu/policy/pol-04-25-05) or [http://www.ncsu.edu/equal_op/](http://www.ncsu.edu/equal_op/). Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.

**Course Schedule**

**NOTE**: The course schedule is subject to change.

**Lecture TH 3:50pm - 5:05pm — Fall 2014 Semester — 08/20/2014 - 12/03/2014**
The schedule is subject to change pending student interests and background. The official schedule will be kept on the course webpage (http://www.csc.ncsu.edu/faculty/robertsd/csc481f14/schedule.php) and updated periodically to reflect changes as the semester progresses. It is the student's responsibility to check the schedule regularly for changes. The instructor will communicate any changes in deadlines to students in a timely manner via email and/or announcements in class. Note, it is the student's responsibility to check their official NCSU email address at least once daily and to come to class. Failure to do so does not excuse missed deadlines.

Here is a rough outline of the course schedule:

Lecture 1: Welcome, Introduction, Course Overview
Lecture 2: Engine architecture
Lecture 3: Gameplay Foundations, Low-level Engine Systems
Lecture 4: Game Loop Architectures
Lecture 5: Multithreading
Lecture 6: Networking, Networked Game Loop Architectures
Lecture 7: Runtime Object Models
Lecture 8: Object-centric models
Lecture 9: Property-centric models
Lecture 10--12: Event Management
Lecture 13: Timelines
Lecture 14--15: Memory Management
Lecture 16--17: Event Synchronization
Lecture 18--20: HIDs
Lecture 21: I/O
Lecture 22: Cache Coherence, Configuration Management
Lecture 23: Resource Management
Lecture 24--26: Scripting
Lecture 27: World Editors
Lecture 28: Architecture summary