CSC 481 Course Syllabus

CSC 481 - Game Engine Foundations

Section 001
FALL 2012
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 four 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 four 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 above section on "Academic Integrity"). The assignments will either be posted on the course webpage 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.

**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 10/11. The final exam is scheduled from 1:00pm - 4:00pm on 12/6. Note, the date of the midterm is subject to change at the discretion of the professor.

**Instructors**

**Dr David L Roberts** (dlober4) - *Instructor*
Email: robertsd@csc.ncsu.edu
Web Page: [http://www.csc.ncsu.edu/faculty/robertsd/](http://www.csc.ncsu.edu/faculty/robertsd/)
Phone: 9195137182
Office Location: EB2 2254
Office Hours: Monday 3:30-5:00, Tuesday 12:00-1:30, and by appointment. 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.

**Robert Loftin** (rtloftin) - *Teaching Assistant*
Email: rtloftin@ncsu.edu
Phone: none
Office Location: EB2 2246
Office Hours: Thursday/Friday, 1:30-2:30

**Course Meetings**

**Lecture**

- **Days:** MW
- **Time:** 3:50pm - 5:05pm
- **Campus:** Centennial
- **Location:** EBII 1231
  
  *This meeting is required.*
Course Materials

Textbooks

Game Engine Architecture - Jason Gregory
Edition: 2nd
ISBN: 1568814135
Cost: $55.60
This textbook is required.

Expenses

None.

Materials

None.

Requisites and Restrictions

Prerequisites

CSC 316

Co-requisites

None.

Restrictions

CSC Majors only

General Education Program (GEP) Information

GEP Category

This course does not fulfill a General Education Program category.

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

Grade Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homeworks</td>
<td>50</td>
<td>There will be up to 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 10/11. The date is subject to change at the discretion of the instructor.</td>
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</tbody>
</table>
Final Exam | 30
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The final will be cumulative, and given during the scheduled exam period from 1:00pm - 4:00pm on 12/6.

**Letter Grades**

**This Course uses Standard NCSU Letter Grading Scale**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</th>
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</thead>
<tbody>
<tr>
<td>A+</td>
<td>97 ≤</td>
</tr>
<tr>
<td>A</td>
<td>93 ≤</td>
</tr>
<tr>
<td>A-</td>
<td>90 ≤</td>
</tr>
<tr>
<td>B+</td>
<td>87 ≤</td>
</tr>
<tr>
<td>B</td>
<td>83 ≤</td>
</tr>
<tr>
<td>B-</td>
<td>80 ≤</td>
</tr>
<tr>
<td>C+</td>
<td>77 ≤</td>
</tr>
<tr>
<td>C</td>
<td>73 ≤</td>
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<td>C-</td>
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<td>63 ≤</td>
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<tr>
<td>D-</td>
<td>60 ≤</td>
</tr>
<tr>
<td>F</td>
<td>0 ≤</td>
</tr>
</tbody>
</table>

**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](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-02-15-4](http://policies.ncsu.edu/regulation/reg-02-15-4).

**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](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. For example, a student who submits the first assignment three days late (and receives 15 points off of their grade) 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

#### Attendance

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.

For complete attendance policies, please see http://policies.ncsu.edu/regulation/reg-02-20-3.

#### Absences

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

#### Makeup Work

There will be no makeup work given for missed assignments.

#### Additional Excuses Policy

None.

### Academic Integrity

#### Academic Integrity

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.

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 "I 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 MW 3:50pm - 5:05pm — Fall 2012 Semester — 08/15/2012 - 12/14/2012**

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/csc481f12/schedule.php](http://www.csc.ncsu.edu/faculty/robertsd/csc481f12/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: Genre-specific requirements on engines
Lecture 2: Engine architecture
Lecture 3: Gameplay Foundations, Low-level Engine Systems
Lecture 4: Runtime Object Models
Lecture 5: Object-centric models
Lecture 6: Property-centric models
Lecture 7--9: Event Management
Lecture 10--11: Memory Management
Lecture 12--15: HIDs
Lecture 16: Timelines
Lecture 17: I/O
Lecture 18: Game Loop Architectures
Lecture 19: Multithreading
Lecture 20: Networking, Networked Game Loop Architectures
Lecture 21--22: Event Synchronization
Lecture 23: Cache Coherence, Configuration Management
Lecture 24: Resource Management
Lecture 25--26: Scripting
Lecture 27--28: Scripting for Multiplayer Games
Lecture 29: Architecture summary