



ITP 485 Programming Game Engines

Units: 4

Spring 2018—MW—2:00 – 3:50pm:

Location: OHE 540

Instructor: Matt Whiting

Office: OHE 530 E

Office Hours:

TBD

Contact Info:

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Teaching Assistant:

Office: TBD

Office Hours: TBD

Contact Info: TBD

IT Help: TBD

Hours of Service: TBD

Contact Info: TBD

Course Description

This course provides students with an in-depth exploration of 3D game engine architecture.

Students will learn state-of-the-art software architecture principles in the context of game engine design, investigate subsystems typically found in a real game engine, survey engine architectures from actual shipped games, and explore how the differences between game genres can affect engine design.

Students will participate in individual hands-on lab exercises to reinforce these concepts.

Learning Objectives

Engine subsystems including rendering, audio, collision, physics, and game world models. Large-scale C++ software architecture in a games context. Tools pipelines for modern games.

Prerequisite(s): ITP-380

Co-Requisite(s):

Concurrent Enrollment:

Recommended Preparation:

Course Notes

Throughout the semester, students will work by themselves to build features in a simplified game engine. These assignments must be completed *individually*.

Each assignment builds upon the previous one, and late assignments cannot be accepted.

From time to time during the semester, we'll have in-class assignments. Each in-class assignment is to be completed individually during the time allotted during that class period and is "open-book". Any and all reference material is allowed, but collaboration is not. This is a chance to practice finding and using reference material.

There are two exams which are comprehensive of all topics covered. The exams are "closed-book".

Technological Proficiency and Hardware/Software Required

The course is taught exclusively in C++ using Windows DirectX 11 and Visual Studio.

Due to the nature of programming with the DirectX API, students should have access to a machine with Windows. If you are on a Mac, you can download Windows from [USC Viterbi Dreamspark](#), and install it on your Mac via Bootcamp. Because we are using DirectX 11, Parallels or VMWare fusion do not work. You have to boot via bootcamp.

Students will have access to usable machines in the classroom, and acceptable laptops can be checked out from either the CS or ITP departments.

Required Readings and Supplementary Materials

Required:

Game Engine Architecture, Second Edition. Jason Gregory. ISBN-13: 978-1466560017.

Optional:

Real-Time Collision Detection. Christer Ericson. ISBN-13: 978-1-55860-732-3.
Effective C++ (3rd Edition). Scott Meyers. ISBN-13: 978-0321334879.

Description and Assessment of Assignments

TBD

Grading Breakdown

Including the above detailed assignments, how will students be graded overall? Participation should be no more than 15%, unless justified for a higher amount. All must total 100%.

Assignment	% of Grade
Participation	5
Lab Assignments	30
In-Class Assignments	15
Midterm	25
Final Exam	25
TOTAL	100

Participation grades will be computed from in-class discussion, responses to in-class survey questions, and participation in piazza discussions.

Grading Scale (Example)

Course final grades will be determined using the following scale

A	93-100
A-	90-92
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	63-66
D-	60-62
F	59 and below

Half percentage points will be rounded up to the next whole percentage. So for instance, 89.5% is an A-, but 89.4% is a B+.

Assignment Submission Policy

Each student will make a git repo on <https://www.bitbucket.org>, and that repo must be shared (for viewing) with the instructor and the TAs. Lab assignments are to be pushed into that git repo.

In-class assignments and exams are generally conducted on paper and will be turned in at the end of the course period.

Grading Timeline

TBD

Additional Policies

There is generally no curving. Students will receive the grade they earn.

Some assignments and exams will get a “do-over” as a take-home assignment. When offered, “do-over” assignments are weighted equally with the original assignment.

Extra credit is generally not offered.

Make-up policy for exams: To make up for a missed exam, the student must provide a satisfactory reason (as determined by the instructor) along with proper documentation. Make-up exams are only allowed under extraordinary and emergency circumstances.

Late Lab Assignments: Lab assignments will not be accepted.

Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings and Homework	Deliverable/ Due Dates
Class 1 1/8	Introduction		In-Class 01 (git repo)
Class 2 1/10	Math Review	§4.1 – §4.4	In-Class 02 a/b
1/15	MLK	No Class	No Class
Class 3 1/17	SIMD	§4.7 Blackboard “SIMD Tutorial”; Begin Lab 01 SIMD	In-Class 03
Class 4 1/22	Custom Memory Allocators	§5.2; §3.3	In-Class 04
Class 5 1/24	Rendering 1	§10.1.0 – §10.1.2.4 Begin Lab 02 Triangle	Lab 01 Due 1/24 @ 2pm
Class 6 1/29	The C++ Compiler		In-Class 06 a/b
Class 7 1/31	Rendering 2	§10.1.4 Begin Lab 03 Cube	Lab 02 Due 1/31 @ 2pm
Class 8 2/5	Rendering 3 Lab 03	§10.1.2.5 – §10.1.3	
Class 9 2/7	Lighting Lab 04	Begin Lab 04 Lighting	Lab 03 Due 2/7 @ 2pm
Class 10 2/12	Game Object Models Lab 04	§15.1 – §15.4	
Class 11 2/14	Objects2 TBD Lab 05	Begin Lab 05 Model	Lab 04 Due 2/14 @ 2pm
2/19	President’s Day	No Class	No Class
Class 12 2/21	Caching and Performance	§3.4, §2.3, §9.8 Begin Lab 06 Profiling	Lab 05 Due 2/21 @ 2pm In-Class 12
Class 13 2/25	Midterm Review		
Class 14 2/27	Midterm Exam		
Class 15 3/5	Animation 1 Lab 07	§11.1 – §11.10 Begin Lab 07 Animation	Lab 06 Due 3/5 @ 2pm
Class 16 3/7	Animation 2 Lab 07		
3/12	Spring Recess	No Class	No Class
3/14	Spring Recess	No Class	No Class
Class 17 3/19	Multithreading	§7.6; §15.6; Begin Lab 08 Job Manager	Lab 07 Due 3/19 @ 2pm In-Class 17 a/b
Class 18 3/21	Hardware & 3D Math Lab 08	§4.1 – §4.6; §4.8	
Class 19 3/26	Collision Detection Lab 09	§12.3; §12.5 Begin Lab 09 Collisions	Lab 08 Due 3/26 @ 2pm

Class 20 3/28	GJK Lab 09		
Class 21 4/2	Normal Maps Lab 10	§10.3 Begin Lab 10 Normal Map	Lab 09 Due 4/2 @ 2pm
Class 22 4/4	Multiplayer	§7.7	
Class 23 4/9	Content Pipelines	§14.4	In-Class 23
Class 24 4/11	Post Effects Lab 11	Begin Lab 11 Bloom	Lab 10 Due 4/11 @ 2pm
Class 25 4/16	Scripting	§15.8	
Class 26 4/18	Audio		In-Class 26
Class 27 4/23	Final Review		Lab 11 Due 4/23 @ 2pm
FINAL 5/7	Final Exam	May 7 @ 2-4 pm	Date: For the date and time of the final for this class, consult the USC <i>Schedule of Classes</i> at www.usc.edu/soc .

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” <https://policy.usc.edu/scampus-part-b/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Support Systems:

Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. <https://engemannshc.usc.edu/counseling/>

National Suicide Prevention Lifeline - 1-800-273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. <http://www.suicidepreventionlifeline.org>

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. <https://engemannshc.usc.edu/rsvp/>

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: <http://sarc.usc.edu/>

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. <https://equity.usc.edu/>

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. <https://studentaffairs.usc.edu/bias-assessment-response-support/>

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. <http://dsp.usc.edu>

Student Support and Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. <https://studentaffairs.usc.edu/ssa/>

Diversity at USC

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. <https://diversity.usc.edu/>

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible, <http://emergency.usc.edu>

USC Department of Public Safety – 213-740-4321 (UPC) and 323-442-1000 (HSC) for 24-hour emergency assistance or to report a crime.

Provides overall safety to USC community. <http://dps.usc.edu>