



School of Engineering  
*Information  
Technology Program*

## **ITP-481 “Game Programming Professional Development”**

**Units:** 2

**Spring 2023**

Tue 2:00-3:50 am

**Location:** OHE 542

**Instructor:** Matt Whiting

**Office:** RRB 221

**Office Hours:**

Mon 3-5 pm (online)

Tue 4-5 pm RRB 221

**Contact Info:**

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**Teaching Assistant:**

**Office:**

**Office Hours:**

**Contact Info:**

**IT Help:** Viterbi IT

**Hours of Service:**

Monday – Friday, 8:30 a.m. – 5:00 p.m.

**Contact Info:**

DRB 205

(213) 740-0517

[engrhelp@usc.edu](mailto:engrhelp@usc.edu)

## **Course Description**

This course will focus on the practical math, algorithms, and other topics relevant to new professionals in 3D video game programming. Particular focus will be centered on presentation and communication skills.

Students will get practice with the application of mathematics, physics, and geometry in the context of common video game scenarios as well as how to communicate about these abstract concepts.

## **Learning Objectives**

Solving common video game programming challenges using 3D geometry, linear algebra, and simple kinematics. Develop confidence and communication skills needed in a professional game development environment.

**Prerequisite(s):** ITP-380

**Co-Requisite(s):**

**Concurrent Enrollment:**

**Recommended Preparation:**

## **Course Notes**

In a typical class meeting, we will begin by covering some theory from the fields of physics, mathematics, and computer science, and then cover practical applications of these topics in the context of video game programming.

The topics covered each week consist mostly of material that students at this level have already been exposed to (having completed ITP-380 and all of its prerequisites). This course will focus on applying those concepts creatively and in combinations that may not have been encountered in previous courses.

We will be focusing on communication throughout the semester. Each week's topic will be the concepts we focus on communicating that week. You should be familiar and comfortable with executing on the weekly topics. We will explore how to translate that familiarity into clear communications about the subject.

Most weeks will include homework to practice with these concepts. Each week, the students will be expected to present their assignment solutions for discussion with the class to develop their professional communication skills.

There will be two exams which are comprehensive of all topics covered. The exams are "closed-book". One of these exams will be written, and one will be conducted as a 20 minute oral exam.

In the place of a final exam, there will be a final programming challenge.

## **Technological Proficiency and Hardware/Software Required**

We will discuss topics in the context of the programming languages of video game development (C++ and/or C#), but the course will be built around written and verbal exercises.

Week 12 will focus on issues specific to the C++ programming language, and the final program will require the students to write a program in C++. It is therefore required that students be proficient with C++ prior to taking this course.

The C++ language will be discussed, and the final program is to be written in C++, but students may use any type of operating system and editor they choose. Students will want access to a computer and a C++ compiler of some kind, but there will not be any *specific* hardware or software required for the course.

## **Required Readings and Supplementary Materials**

### **Required:**

*Mathematics for 3D game programming and computer graphics (3<sup>rd</sup> Edition)*. Eric Lengyel. ISBN-13: 978-1-4354-5886-4.

*Cracking the Coding Interview: 189 Programming Questions and Solutions (6<sup>th</sup> Edition)*. Gayle Laakmann McDowell. ISBN-13: 978-0984782857.

### **Optional:**

*Real-Time Collision Detection*. Christer Ericson. ISBN-13: 978-1-55860-732-3.

*Essential Mathematics for Games and Interactive Applications (3<sup>rd</sup> Edition)*. James M. Van Verth, Lars M. Bishop. ISBN-13: 978-1482250923.

## **Description and Assessment of Assignments**

There are 10 written homework assignments each consisting of multiple problems applying the topics covered up to that point in practical examples of common video game situations. These assignments are to be completed individually prior to the beginning of the following class meeting. In addition to turning these assignments in to be graded, each student must be prepared to present their solutions for discussion with the class.

It is expected that students will spend about 4 hours per week working on these assignments outside of class.

## **Homework**

The homework assignments typically consist of (up to) 10 exercises worth 10 points each.

For the first 9 exercises on each homework assignment, 40% of available points are given for any reasonable attempt, an additional 40% is earned for demonstration of a viable approach to solving the problem, and the final 20% will be awarded for a correct answer.

Each homework assignment concludes with a 10<sup>th</sup> exercise where the student is asked to demonstrate an understanding of the week's material and how it relates to the field of video game programming by creating their own problem along with the solution.

Assignments should be worked on paper and will be turned in at the beginning of each class meeting. Hand-written assignments are expected to show all work and include clearly understandable diagrams illustrating the concepts being applied.

## Presentation

The presentation grade is based on the presentation of homework assignments. Each student will be expected to present homework solutions at least twice per semester and present their original exercise at least once per semester.

## Midterm (Written)

The midterm exam will be conducted on paper and will be turned in at the end of the course period. The midterm exam will consist of questions similar to those seen during the weekly assignments but will not be identical to questions that have already been covered. The exam will cover all the material up to that point.

## Midterm (Oral)

The second exam will be a 20-minute oral exam where the students meet individually with the instructor to establish mastery of the material and presentation skills. The material in this exam will be cumulative to cover everything from the beginning of the semester up to this point.

There is no class meeting during that week. Instead, each student must schedule a 20-minute session with the instructor during the course of that week.

## Final Program

The final for the course comes in the form of a program the students must write. The specifications for that program will be given during the last class session, and the program must be turned in by 8 am on the date the final exam is scheduled for this class.

The requirements for this final program will potentially cover any topics from any point in the course.

The students are expected to write their program individually, and the grade is based on the functionality and performance (speed) of the final program. The program is expected to be written in C++.

## Grading Breakdown

Assignment	% of grade
Homework	35
Presentation	10
Midterm (Written)	20
Midterm (Oral)	15
Final Program	20
<b>TOTAL</b>	<b>100</b>

## Additional Policies

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 Assignments:* Late assignments will be accepted with a deduction of 20% plus 10% for each additional 24 hour period past the original deadline.

*Assignment Redo:* Most of the homework assignments have the opportunity of a “redo”. The student is allowed to correct the assignment and turn it in again. The “redo” assignments are weighted the same as the original assignments. All “redos” must be turned in by the date of the final program.

## Course Schedule: A Weekly Breakdown

Week	Topics/Daily Activities	Readings and Homework	Deliverable/Due Dates
<b>Class 1</b> 1/10	Introduction	McDowell §I-II Homework #1 (Intro)	
<b>Class 2</b> 1/17	Vector Operations	Lengyel §2.1-2.3 Homework #2 (Vectors)	Homework #1 (Intro) due
<b>Class 3</b> 1/24	Linear Algebra and Transformation Matrices	Lengyel §3.1-3.3; §4.1-4.6 Homework #3 (Matrices)	Homework #2 (Vectors) due
<b>Class 4</b> 1/31	Intersections: Spheres, Lines, and Planes	Lengyel §5.1-5.2; §12.1; §12.4 Homework #4 (Intersections)	Homework #3 (Matrices) due
<b>Class 5</b> 2/7	Intersections: Hulls and Triangles	Homework #5 (Triangles)	Homework #4 (Intersections) due
<b>Class 6</b> 2/14	Frustum and Spatial Partitioning	Lengyel §5.3; §8.2-8.3	Homework #5 (Triangles) due
<b>Class 7</b> 2/21	<b>Midterm #1 (Written)</b>		
<b>Class 8</b> 2/28	Basic Kinematics, Rotational Physics,	Lengyel §13; §14.1-14.2 Assignment #6 (Physics)	
<b>Class 9</b> 3/7	Common Algorithms	McDowell §IX.1-4 Homework #7 (Algorithms)	Homework #6 (Physics) due
<b>No Class</b> 3/14	<b>Spring Recess No-Class</b>		
<b>Class 10</b> 3/21	Dynamic Programming	McDowell §IX.8	Homework #7 (Algorithms) due
<b>Class 11</b> 3/28	<b>Midterm #2 (Oral)</b>		
<b>Class 12</b> 4/4	C++	McDowell §IX.12 Homework #8 (C++)	
<b>Class 13</b> 4/11	Integer Representations	McDowell §IX.5-6 Homework #9 (Fixed-Point)	Homework #8 (C++) due
<b>Class 14</b> 4/18	Cache and Hardware Concerns	Homework #10 (Cache)	Homework #9 (Fixed-Point) due
<b>Class 15</b> 4/25	Final Review		Homework #10 (Cache) due
<b>FINAL</b>	Final Programming Challenge	Due 2 pm on May 4th	

## 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” [policy.usc.edu/scampus-part-b](http://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, [policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

### Support Systems:

*Counseling and Mental Health - (213) 740-9355 – 24/7 on call*

[studenthealth.usc.edu/counseling](http://studenthealth.usc.edu/counseling)

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

*National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call*

[suicidepreventionlifeline.org](http://suicidepreventionlifeline.org)

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

*Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call*

[studenthealth.usc.edu/sexual-assault](http://studenthealth.usc.edu/sexual-assault)

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

*Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298*

[equity.usc.edu](http://equity.usc.edu), [titleix.usc.edu](http://titleix.usc.edu)

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

*Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298*

[usc-advocate.symplicity.com/care\\_report](http://usc-advocate.symplicity.com/care_report)

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

*The Office of Disability Services and Programs - (213) 740-0776*

[dsp.usc.edu](http://dsp.usc.edu)

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

*USC Campus Support and Intervention - (213) 821-4710*

[campussupport.usc.edu](http://campussupport.usc.edu)

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

*Diversity at USC - (213) 740-2101*

[diversity.usc.edu](http://diversity.usc.edu)

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

*USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu), [emergency.usc.edu](http://emergency.usc.edu)

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

*USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu)

Non-emergency assistance or information.

*Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)*

[ombuds.usc.edu](http://ombuds.usc.edu)

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.