GAM 374/474: Fundamentals of Game Programming I

Professor Robin Burke

Spring 2013, Section 601/610, CDM 202

Tu/Th 10:10 ─ 11:40 am

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Course web site: http://d2l.depaul.edu/

Description

The objective of this course is to learn the fundamental concepts of game programming using C/C++ and OpenGL. Students will learn how to implement simple 3D action games including: 3D rendering operations including texture mapping, physical interactions including collisions, input / output management including game UI, analog controllers, and sound. Emphasis will be placed on the development of the coding skills needed for robust, efficient, and portable implementation.

Prerequisites

(CSC 393 or (CSC 309 and CSC 301)) and GPH 321

Course Texts

Linhoff, J. *Fundamentals of Game Programming in C/C++ and OpenGL.* Available from Lulu.com: http://bit.ly/igFwOb
Shreiner, D. *OpenGL Programming Guide, 7th ed. The Official Guide to Learning OpenGL.* Addison-Wesley, ISBN: 978-0-321-55262-4

Resources

All of our programming will be in C/C++. I will distribute solution files compatible with the Standard or Express Edition (with the Platform SDK) of Microsoft Visual Studio 2010 C/C++. The labs on the fourth, sixth, and seventh floor are sufficiently equipped for this course. If you would like to use your own system, it must be running Windows XP/Vista/7, have the above development environment, and a video card and driver that can handle at least an 800x600 32-bit OpenGL 1.1 window.

In addition to Visual Studio, we will make use of the following tools:

- QE – an OpenGL-based game engine
- TortoiseSVN -- source control program
- Either
    - Paint.NET – a very simple image editing program, or
    - GIMP – a more sophisticated image editor.
- Audacity – a simple sound editing program

Other custom tools will be provided as necessary.

Web Site

The course web site will host copies of handouts, lecture notes, and links to useful resources: http://d2l.depaul.edu/

The schedule and other syllabus information may change during the quarter: the web site will contain the most up-to-date information.

Grades for assignments will posted on D2L, but no assignments will be accepted through this site. Assignments must be submitted by SVN commit. See below.

Organization and Assessment

GAM 374 will meet twic a week. Class sessions will include lecture, discussion, in-class exercises and activities. Students are expected to attend all classes, do the assigned reading before class time and complete all labs and homework assignments. Undergraduate students will be organized into teams that will work together throughout the quarter and on the final team game. There will also be two quizzes and three lab sessions.

Grading will based on accumulated points:

A	2301+	
A-	2151	2300
B+	2001	2150
B	1851	2000
B-	1701	1850
C+	1551	1700
C	1401	1550
C-	1301	1400
D+	1201	1300
D	1101	1200
F	below 1100	

Different elements of the course are worth different numbers of points.

- Participation: Each class attended is worth 15 points, with possible bonuses for insightful or helpful involvement. Bonus points can also be earned for participation in the online forum. Possible points: 225.
- Labs: Each lab completed is worth 25 points. Lab exercises can be completed outside of class time without penalty but are always due one week after the lab session. Possible points: 75
- Quizzes: There are two quizzes, which are open book and open notes. Each is worth 200 points. Possible points: 400
- Homework: There are seven homework assignments. They are arranged into tiers. All of the assignments in one tier should be completed before moving on to the next tier. Two of the assignments are "mini-bosses." If everyone on the team has completed all of the previous tier assignments before the due date for the mini-boss assignment, then everyone on the team receives a 100 point bonus.
  - Tier 0
    - H1: Hello, World (100 points)
  - Tier 1
    - H2: Boxes / Tanks (150)
    - H3: Diag (150)
  - Mini-boss
    - H4: Pong (350)
  - Tier 2
    - H5: HUD (150)
    - H6: Collisions (150)
  - Mini-boss
    - H7: Asteroids (350)

- Team game: The team game is a group project that serves as the final "boss" of the course. As with H4 and H7, if everyone on the team has completed their Tier 0, Tier 1 and Tier 2 assignments, then the entire team gets a 100 point bonus for the team game. Each team must also make a presentation of their game at the end of the quarter. (300 [game] + 100 [presentation] = 400 possible points)

Distance Learning Students

Distance learning students have requirements that are slightly different from in-class students.
- Participation: In lieu of in-class participation, DL students will be expected to complete any in-class worksheets and to post regularly on the course discussion board. Each worksheet completed will be worth 10 points (total of 12) = 120 points. Posts to the course discussion board will be worth from 0 – 15 points, with a maximum of 15 points per week. I will expect at least one post per week. Possible points: 225.
- Labs: Labs will be turned in like homework for DL students rather than completed during class time. Lab sessions will be recorded so that you have the same opportunity to walk through the exercises.
- Teamwork: Like in-class students, DL students will be divided into teams early in the quarter. There will be discussion boards for each team. The final project will also be completed as a team, requiring close coordination, so it is recommended that team members get to know each other in advance. Skype or, if possible, face-to-face discussion outside of class will be important for this part of the class. Mixed DL/in-class teams will be permitted at student request and the instructor's discretion.
- Team meetings: I will be scheduling team meetings either in person or via Skype for all game teams including DL teams during Week 9.

Graduate students

Graduate students (and undergraduate enrolled in a combined degree program) do not have the same bonus structure. Also, their homework will be held to a higher standard. Graduate students may work in two-person teams on the final project or may work solo (with instructor permission).

Homework

The most important aspect of the course is the portfolio of homework assignments. This course emphasizes professional standards in coding. Each assignment will have a rubric describing the features required to earn the required points. For example, the rubric for the first "Hello, World" assignment is included below. An assignment that does not meet the minimum requirements listed in the rubric must be resubmitted. Resubmitted assignments can only earn "Basic" credit. Assignments may be submitted up to 1 week late with a 20% penalty. An assignment more than one week late will receive 0 credit and cannot be resubmitted. Assignments can be resubmitted at any time.

To summarize:
- Assignments more than one week late: 0 points
- Assignments turned in late and meeting "Minimum" requirements: 20% penalty on rubric score
- Assignments turned in on time but not meeting "Minimum" requirements: resubmit required
- Assignments turned in on time and meeting "Minimum" requirements: score via rubric
- Resubmitted assignments: Scored only on "Basic" requirements of rubric
- Assignment not resubmitted: 0 points

Tentative Class Schedule
(FGP = "Fundamentals of Game Programming", RB = "OpenGL Programming Guide" aka "Red Book")

4/2: Introduction to the class. Syllabus, organization and assignments. Expectations. Version control and SVN.

4/4: OpenGL. OpenGL graphics library: basic concepts and usage. The Quarter Engine (QE).
Reading: FGP Ch. 1-3; RB Ch. 1, Ch. 2 through "Basic State Management"

4/9: Data types and multi-platform issues. Writing excellent code. Coding standards for this course: files, functions and blocks, identifiers, and documentation.
Reading: FGP Ch. 5-14
Due: Homework 1: Hello World

4/11: 3D graphics. 3D objects and conventions. Coordinate systems and transformations. Coding / drawing. Drawing and managing 3D objects.
Reading: RB Ch. 3 through "Manipulating the Matrix Stacks"

4/16: Input and sounds. Handling buttons and other input devices. The XBox 360 controller . Multi-channel sound. Managing game sounds.
Reading: FGP Ch. 15-16
Due: Homework 2: Boxes and Tanks

4/18: Lab: Debugging.

4/23: Simple game physics. Moving objects. Concepts in collision detection .
Reading: FGP Ch. 17 (except "Camera Monkeys"), 18, 19
Due: Homework 3: Diag

4/25: Cameras and images. Cameras: Othographic, bitmap and perspective views. Loading, drawing and managing images. Quiz 1.

4/30: Texture mapping. Basic concepts of texture application. UV coordinates, texels and rendering operations.
Reading: FPG Ch. 20-21, RB Ch. 9 through "Texture Objects"
Due: Homework 4: Pong

5/2: Lab: Texture mapping.

5/7: Collisions I. Collision detection in 3-dimensions. Bounding spheres. Line to plane techniques.
Reading: FGP Ch. 22-24
Due: Homework 5: HUD

5/9: Project planning. Design pitches.

5/14: Collisions II. Responding to collisions. Strategies for dealing with tunneling. Walking / sliding.
Reading: FGP Ch. 25-26
Due: Homework 6: Collisions

5/16: Game logic: Game modes and levels. Organizing and integrating game code.
Reading: FGP Ch. 28-30

5/21: First-person games. Camera transformations. Attaching cameras to game objects. Multiple cameras and views.
Reading: FGP Ch. 17 "Camera Monkeys"

Due: Homework 7: Asteroids

5/23: Lab: Maya for programmers

5/28: Quiz 2 / Team meetings

6/4: Project presentations I

6/6: Project presentations II

6/11: Projects due

Policies
Students are expected to attend all classes and participate in in-class exercises. Class will start promptly. I will take attendance. Arrival more than 10 minutes late for class will constitute an absence. Students are individually responsible for material they may have missed due to absence or tardiness.

Assignments (except for designated group assignments) must represent a student's individual effort. While students are permitted to discuss assignments at the conceptual level, under no circumstances should students share code (electronically or otherwise). Use of sources without attribution constitutes plagiarism, a serious violation of academic integrity. Consult the assignment handouts or the instructor if you have questions about how or what to document. The bottom line: do all of your own original work and do not copy from fellow students or past assignments.

School Policies

Disability
Students who feel they may need an accommodation based on the impact of a disability should contact me privately to discuss their specific needs. All discussions will remain confidential.
To ensure that you receive the most appropriate reasonable accommodation based on your needs, contact me as early as possible in the quarter (preferably within the first week of class), and make sure that you have contacted the:PLuS Program (for LD, AD/HD) at 773-325-1677, Student Center #370, and/or The Office for Students with Disabilities (for all other disabilities) at 773-325-1677, Student Center #370

Online Instructor Evaluation
Course and instructor evaluations are critical for maintaining and improving course quality. To make evaluations as meaningful as possible, we need 100% student participation. Therefore, participation in the School's web-based academic administration initiative during the eighth and ninth week of this course is a requirement of this course. Failure to participate in this process will result in a grade of incomplete for the course. This incomplete will be automatically removed within seven weeks after the end of the course and replaced by the grade you would have received if you had fulfilled this requirement.

Email
Email is the primary means of communication between faculty and students enrolled in this course outside of class time. Students should be sure their email listed under "demographic information" at http://campusconnect.depaul.edu/ is correct.

Plagiarism
The university and school policy on plagiarism can be summarized as follows: Students in this course, as well as all other courses in which independent research or writing play a vital part in the course requirements, should be aware of the strong sanctions that can be imposed against someone guilty of plagiarism. If proven, a charge of plagiarism could result in an automatic F in the course and possible expulsion. The strongest of sanctions will be imposed on anyone who submits as his/her own work a report, examination paper, computer file, lab report, or other assignment which has been prepared by someone

else. If you have any questions or doubts about what plagiarism entails or how to properly acknowledge source materials be sure to consult the instructor.

Incomplete
An incomplete grade is given only for an exceptional reason such as a death in the family, a serious illness, etc. Any such reason must be documented. Any incomplete request must be made at least two weeks before the final, and approved by the Dean of the College of Computing and Digital Media. Any consequences resulting from a poor grade for the course will not be considered as valid reasons for such a request.

Quarter at a Glance

Week	Dates	Reading	Topic	Due
1	4/2, 4/4	FPG 1-3, RB Ch 1, Ch 2 through "Basic State Management"	Intro to the class. OpenGL / QE	
2	4/9. 4/11	FPG 5-14, RB Ch. 3 through "Manipulating the Matrix Stacks"	Coding standards, 3D objects and conventions, Defining and drawing a world	Hello, World
3	4/16, 4/18	FPG 15-16	Input and sounds. Lab: Debugging	Boxes
4	4/23, 4/25	FPG 17-19	Bitmapping / icons / Simple physics. Quiz 1	Diag
5	4/30, 5/2	FPG 20-21, RB Ch. 9 through "Texture Objects"	Texture mapping. Lab: Texture mapping	Pong
6	5/7, 5/9	FPG 22-24	Collisions I. Design pitches	HUD
7	5/14, 5/16	FPG 25-26, 28-30	Collisions II. Game logic	Collision
8	5/21, 5/23	FPG 27	First-person games. Lab: Maya for QE	Asteroids
9	5/28, 5/30		Quiz 2 / Team meetings	
10	6/4, 6/6		Presentations	
Finals Week	6/11			Project and all assignments