CSC 421/521: Computer Gaming

12:30 - 1:45 p.m. TR
CI 2006
Labs: Digital Arts Lab, BR 165

CSC 421/521. Computer Gaming (3) Prerequisites: CSC 320 (ART 320) (FST 320), 340, and 370. Topics related to the design and implementation of computer games are covered, including design, modeling, and animation of meshes for game characters and environments, scene and object representation, graphics pipeline, collision detection, picking, graphics optimization, and other issues such as basic physics and AI for games. Meshes and animations will be created using 3D software, and code modifications and additions to a game engine will be made.

Course Information:
This course covers a survey of information related to modern computer gaming and related mathematical, coding, and graphics material with an emphasis on game-engine architecture and applied game-construction using current systems. With this in mind, the course is largely project based. Class lectures cover game-related design, history, mathematics, programming, architecture, asset construction, animation, and basic related concepts such as simulation and artificial intelligence. Students are tested on conceptual and technical material and also evaluated based on achieving goals with hands-on homework and project assignments. Students must present work for projects, and work is critiqued by class and instructor after presentation.

Required Textbooks:
Game Engine Architecture by Jason Gregory, Jeff Lander, and Matt Whiting.
Game Design Workshop: A Playcentric Approach to Creating Innovative Game (2ed) by Tracy Fullerton.
UDK Game Development by Alan Thorn.

Recommended, Optional Textbooks:
C++ For Game Programmers by Mike Dickheiser.

Useful:
Maya, ZBrush, Nuke, Photoshop, Illustrator, Final Cut Pro, etc. on computers in the Digital Arts Lab.

Maya Resources housed in the Randall Library, including these and more:
The Art of Maya
MEL Fundamentals Courseware
Learning Maya: Character Rigging and Animation
Learning Maya: Games and Interactive
Maya Seminars: Optimizing a Production Pipeline
Rendering 2D Effects in a 3D Environment
Particles for Visual Effects
Exploring Advanced Shading Networks
Polygon Texturing, Lighting, and Shading
Inside the Maya Architecture
Hyper-Realistic Body Setup
Digital Tutors discs covering topics such as modeling, animation, shading, MEL, and Python for Maya.
Schedule of Topics (tentative)

Overview of computer gaming history and game design.

Basic graphical and 2D game concepts.

Review of linear algebra and C++/OO concepts.

Overview of advanced game engine architecture.

Mathematics and algorithms for object representation and intersection testing using polygons, curves, and surfaces.

Concepts of a graphics pipeline for realtime rendering.

Design and implementation of 3D models for game characters and terrain.

Animation of game characters.

Basics of artificial intelligence and physics related to game design.

Grades:

Project 1: Game Design. 5%
Project 2: 2-D Game Implementation. 15%
Project 3: Asset Creation. 10%
Project 4: 3-D Game Implementation. 25%
Homework. 20%
Tests/Quizzes. 20%
Class participation, discussion, and presentations. 5%

521 Students will have an additional project with a research-related component that will be included in the homework percentage of grading. There will also be additional readings.

Assignments and Projects:

Assignments consist of homework exercises geared toward learning concepts and practicing skills on smaller, focused tasks. These consist of assignments such as completing C++ tutorials for an open-source game engine, coding and modifying existing code, following character modeling and rigging exercises, modeling game terrains in 3D software, and reading and answering questions related to mathematics and coding for game engines.

Projects consist of designing key aspects of a game based around a theme; implementing a 2-D game through coding with an existing game engine; designing, modeling, rigging, and animating 3-D game assets; and finally implementing a 3-D game using game assets, code, and an existing game engine.
**Student Learning Outcomes:**

1. Students gain understanding in mathematical, algorithmic, and conceptual techniques related to generating, displaying, and animating meshes for 3D computer games.

2. Students develop the ability to model and rig objects and characters in 3-D geared for realtime rendering and use in advanced game engines.

3. Students learn aspects of object representation, scene-graph hierarchy, and algorithms related to real-time rendering of graphical objects.

4. Students learn and apply mathematical concepts, including linear algebra, parametric equations, and quaternions, needed for 3D computer gaming.

5. Students learn, discuss, and consider the history, development, and design of computer games as well as basic artificial intelligence and physics for games.

6. Students design and code their own 2D game, creating all resources (sprites, images, sounds), modifying and expanding source-code of a modern game engine for main control of rendering.

7. Students design and code their own 3D game in small groups, creating all resources (3D models, 3D terrain, textures, character rigging and animation) necessary for it, modifying and expanding source-code of a modern game engine for game control and rendering.

**Class Policies**

Skills required for this course include programming experience (C or C++ preferable) and some understanding of 3-D graphics concepts. Formal prerequisites include ART/CSC/FST 220 and 320, CSC 340, and CSC 370. Projects will be presented in class on their due dates with open critiques and discussion. Coding, modeling, and animating are all very time-consuming. Plan carefully to complete projects in a timely manner. Late work will be reduced in grade by 5 points each day. There are no make-up quizzes. Please contact me in advance, if possible, if you must miss any graded work.

Reading assignments and homework will be given from the texts. As class time will be limited, students will need to read, model, animate, and develop extensively outside of class. Material for unannounced quizzes may come from textbooks, assigned outside reading, and supplemental materials as well as lecture material.

As projects may be collaborative efforts, attendance is required. Grades will be both directly and indirectly affected by absences -- covered material is very pertinent to completing homework and projects effectively. More than three class absences may result in course failure. Students are individually responsible for keeping current with course material and assignments.

Class announcements supersede posted material.

Academic honesty in all your work is required for a passing grade.

This syllabus and course materials may be subject to change with reasonable notice.