I. Proposed Catalog Entry

Short Title: Animation & Planning in Games
Long Title: Animation & Planning in Games
Num. Credits: 3.0
Prerequisites: CSCI 4041 or CSCI 4611
Catalog Description: This course covers the theory behind the algorithms used to bring large virtual worlds to life. A broad range of computer animation topics is covered, with a focus on real-time, interactive techniques used in modern games. Topics include: physically-based animation, motion planning, character animation, and simulation in virtual worlds.
Frequency: Odd Years, Fall Term

II. Detailed Class Info

This course will be programming intensive, with students turning in a coding projects every 2 or 3 weeks. The instructor will cover material in lectures, though students will be expected to read relevant research papers each week or two (8-10 pages), along with relevant technical specifications and tutorial (e.g., OpenGL tutorials). Students will also do a final project demonstrating a working system with real-time animation (such as a computer game, or a tech. demo). This project will be accompanied by a presentation. A sample course syllabus is attached at the end of this document.

Potential Instructors: Stephen J. Guy

Learning Objectives
This course will meet several learning objects including (LO1) - Can identify, define, and solve problems, (LO2) - Can locate and critically evaluate information, and (LO5) - Can communicate effectively.

Students will meet Objective 1 (Solve Problems), throughout the course. The main focus of the course will be on how to solve problems that arise when trying to create lively animated environments in games and virtual worlds. Lectures will cover various tools, data structures, and algorithms commonly used in practice and we will focus on how to combine these techniques to solve new animation problems. This learning objective will be evaluated mainly through the use of course projects.   In these projects, students will be asked to animate a new scenario. To complete the project students will need to identify which techniques we discussed in class are most relevant to the new scenario, and will need to develop and extend these methods to solve the problems in the assignments. Students will need to define their chosen techniques and approaches in an accompanying write-up.

Students will also meet Objective 2 (Locate Information) and Objective 3 (Communicate Effectively) as part of their final projects and in-class presentations. Students will need to locate papers discussing recent advances in computer animation (e.g., in scholarly journals), evaluate and discuss these papers as part of a class presentation, and extend on this work in their final project. The effectiveness of their communication will be evaluated through observing their presentation, and participation in class discussion.

III. Requirements Satisfaction
-This course would satisfy the breadth requirement as an "Applications" area course.
-This course will have a large project component, which will satisfy the project requirements of the Plan-C masters program.

IV. Evidence of Student Demand
Computer games, VR, and graphics are perennially a strong draw into computer science. A pilot offering of this course in Fall 2013 had 15 students register, several of whom explicitly expressed their belief it should be turned into a regular course.

There is clearly broad interest in game related programming at the university. Other gaming related courses such as CSCI 4980::Design and Implementation of Game Engines, have filled up completely. The Video Game Development Club has an active mainly list with over 100 members, and regular meetings with 20-40 students who are interested in game development and programming. The proposed course has the potential to interest many of these students.

V. Approval from CS Area
The graphics faculty strongly support this course. The course sequence of CSCI 4611, CSCI 5607, and CSCI 5111 (this course), would put a student well positioned to apply for industry jobs in video game development, computer graphics, and related fields.

VI. Relationship Outside Department
This course is not expected to overlap with any courses outside the department.

CSCI 5611: Animation and Planning (3 credits)

Welcome to CSCI 5611 Animation & Planning in Games. This course is designed to introduce you to the state-of-the art in animation, AI, motion planning and other technologies that are used to bring digital worlds to life. There are many exciting topics in the filed, I am happy to adjust what we covered based on the interest of those in the class, let me know if there are some areas of particular interest to you.

Basic Information

Instructor: Stephen J. Guy
E-mail: sjguy@umn.edu
Office: 6-189
Office Hours: [TBD]
I'm generally available if you have questions about the course, or just want to chat about exciting ideas.

Course Overview

Course Objectives
The main goal of this course it to expose students to current motion planning and animation techniques and to provide them experience with implementing these techniques in the context of games, simulations and virtual environments. A secondary goal for this course is that students develop and exercise the skills needed to be an independent researcher working on the cutting edge of a discipline.

Course Materials
As this course covers state-of-the-art approaches, no textbook adequately covers the course material. However, students should become familiar with reading relevant APIs, and using digital resources for accessing recent scientific papers.

Prerequisites
The official prerequisite for this course is CSCI 4041 (Algorithms) or CSCI 4611 (Programming Graphics & Games). Success in this class requires a solid understanding of basic calculus and substantial programming experience. Material in the course builds on topics from vector calculus, computer graphics, 2/3D digital art, game programming, artificial intelligence, and probability. Prior experience in some of these areas is helpful, though not required.

Expectation of Student

Class Participation
Ask questions! We will be covering very recent work, and not all questions will have clear answers, but asking questions is likely to spur good class discussions.
Classroom Behavior
Please minimize use of laptops, tablets, smart phones and other electronics.
Please avoid eating in class; I'm fine with beverages.

Programming Experience
Use any language or programming tools you are familiar with. Cite *any code* you got from elsewhere.

Plagiarism & Academic Dishonesty
Note prominently any sources you got code from or libraries you used and people you worked with.
Never falsify data, analysis or research procedures.

Assignments and Grading

Course Work

This class will have about 4 programming assignments, a student led lecture, and a final programming project. The final project can be completed in pairs. Students are expected to turn in each assignment. There will be no final exam, but students will be asked to give a presentation of their final project during exam time and turn in a write-up.
This course will count for one-half of the masters plan C project requirement.

Grading Breakdown
40% Programming Projects, 50% Final Project, 10% Student Presentations

Assignments
Assignments will be given primarily during the first half of the course, during the second half students are expected to be working on the Final Project. The exact assignments vary each semester, but the following should give an expectation of the type of work that will be assigned:

-Particle System: Create a particle system that resembles an animated fountain, fire or some other natural phenomena.
-Motion Planning: Plan the path a character can take through a virtual environment with obstacles.
-Flocking and Crowds: Animate agents to follow paths in the style of flocks, herds and schools. Plan intelligent paths for multiple agents who must navigate around each other.
-Character Animation: Display an articulated character walking in an environment.
-Student-led Lecture: Students will prepare a 20-minute lecture that presents a recent paper from the field. I will provide a list of suggested recent papers on the course webpage.

Approximate Schedule*
Week 1 – Introduction to Graphics Programming
Week 2 – Particle Systems & Dynamics
Week 3 – Physically Based Animation & Collision Detection
Week 4 – Water and Cloth Simulation
Week 5 – Collision Avoidance & Flocking
Week 6 – Crowd Simulation
Week 7 – Motion Planning & Path Finding
Week 8 – Inverse Kinematic & Character Animation
Week 9 – Data-driven Techniques & Final Project Proposals
Week 10 – Student-led lectures
Week 11 – Student-led lectures
Week 12 – Student-led lectures
Week 13 – Special Topics
Week 14 – Special Topics
Week 15 – Review & Special Topics
Finals – Project Presentations

*This schedule *will change*, as we invariably get ahead or behind in material and discover new topics of interest. I will try to arrange guest lectures from experts on relevant topics. Conference travel may overlap with a class causing postponement of material or alternate activities. Check the course webpage for updates.

Additional Information

Statements on disabilities, mental health, non-discrimination, and sexual harassment can be found on the course webpage.