CS 4300/5310 – Computer Graphics

Spring 2013 Course Syllabus

Course Information

Professor Gillian Smith
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Office Hours: Tuesdays 1:30 – 3:30pm, or by appointment

TA: Morteza Delgir
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TA Hours: Wednesdays, time TBA

Lecture time: Tuesdays 11:45am – 1:25pm, Thursdays 2:50pm – 4:30pm
Lecture location: West Village H, 108

Course website: http://www.ccs.neu.edu/course/cs5310sp13/
Piazza: https://piazza.com/northeastern/spring2013/cs43005310/home

Course Description and Pre-requisites

Charts a path through every major aspect of computer graphics with varying degrees of emphasis. Discusses hardware issues: size and speed; lines, polygons, and regions; modeling, or objects and their relations; viewing, or what can be seen (visibility and perspective); rendering, or how it looks (properties of surfaces, light, and color); transformations, or moving, placing, distorting, and animating and interaction, or drawing, selecting, and transforming. Covers two-dimensional algorithms for drawing lines and curves, anti-aliasing, filling, and clipping. Studies rendering of three-dimensional scenes composed of spheres, polygons, quadric surfaces, and bi-cubic surfaces using ray-tracing and radiosity. Includes techniques for adding texture to surfaces using texture and bump maps, noise, and turbulence.

Pre-req (undergrad): (a) CS 1500, CS 2510, or CS 3500 and (b) MATH 1260, MATH 2331, or MATH 2341.
Pre-req (grad): knowledge of linear algebra

This course will involve several programming assignments. Students should be comfortable with independently writing and debugging their own programs in Java or another object-oriented language and not be afraid of math.

Learning Objectives

By the end of this course, students should be able to do the following:

Conceptual knowledge

- Explain the benefits and drawbacks of different representations for color
- Describe the rendering pipeline and point to how and where it is programmable
- Understand images as 2D signals, and pixels as samples of a continuous 2D function
- Explain different methods for rendering 3D scenes and identify their tradeoffs
- Identify general computer graphics research and application areas

Practical experience

- Implement algorithms for drawing and processing images
- Develop a modular raytracer that can create realistic-appearing static images
- Develop interactive, 3D graphics applications using OpenGL
- Design and implement visual debugging strategies

General skills

In addition to the graphics-specific skills listed above, this course also aims to:

- Build confidence in learning new languages and APIs
- Improve written and oral communication skills
- Impart effective strategies for reading research papers

Course Materials

The *required* textbook we will be using in this class is:

> **Fundamentals of Computer Graphics: Third Edition**
> Peter Shirley, Steve Marschner
> CRC Press, 2009

You may also find the following optional resources helpful throughout the semester:

> **Foundations of 3D Computer Graphics**
> Stephen J. Gortler
> MIT Press, 2012
>
> **The OpenGL Superbible, Fifth Edition**
> Richard S. Wright, Nicholas Haemel, Graham Sellers, Benjamin Lipchak
> Addison-Wesley Professional, 2010

Participation Policy

Participation in discussions is an important aspect on the class, and contributes towards 10% of your grade. Participation on the Piazza discussion forums (e.g. asking and answering questions about assignments, discussing readings, midterm review) also counts towards this grade. It is important that both students and instructional staff help foster an environment in which students feel safe asking questions, posing their opinions, and sharing their work for critique. If at any time you feel this environment is being threatened—by other students, the TA, or the professor—speak up and make your concerns heard. If you feel uncomfortable broaching this topic with the professor, you should feel free to voice your concerns to the Dean's office.

Collaboration Policies

We learn best through collaboration with others. Students are **strongly encouraged** to collaborate through discussing strategies for completing assignments, talking about the readings before class, and studying for the midterms. However, **all work that you turn in to me with your name on it must be in your own words or coded in your own style.** Directly copied code or text from any other source is **not** allowed. Feel free to discuss general strategies, but any written work or code should be your own, in your own words/style. If you have collaborated on ideas leading up to the final solution, give each other credit on what you turn in, **clearly** labeling who contributed what ideas. Individuals should be able to explain the function of **every** aspect of group-produced work. **Do not abuse this policy or you will make your instructor very sad.** Not understanding what plagiarism is **does not** constitute an excuse for committing it. You should familiarize yourself with the University's policies on academic dishonesty at the beginning of the semester. If you have any doubts whatsoever about whether you are breaking the rules – ask!

To reiterate: **plagiarism and cheating are strictly forbidden**. No excuses, no exceptions. **All** incidents of plagiarism and cheating **will** be sent to OSCCR for disciplinary review.

Assignment Late Policy

Assignments are due **by 11:59pm** on the due date marked on the schedule. Late assignments will receive a 10% deduction per day that they are late, including weekend days. It is your responsibility to determine whether or not it is worth spending the extra time on an assignment vs. turning in incomplete work for partial credit without penalty.

Each student has a total of 5 "late days" that can be used as desired to avoid the late penalty for assignments. Late days may not be used on projects or reading responses. If turning in an assignment late, make sure you clearly state how many late days you are electing to use. Late days can be used for any reason you want, you don't need to explain yourself. But please note that the late days exist for

helping **you** with time management—if you have a cold and need to rest instead of work, then that's a late day. If you have three assignments for different classes due on the same day and need more time for this one, then that's a late day. If you want to go to a concert with friends or need to travel for team sports, then that's also a late day. Budget your time wisely.

Any exceptions to this policy (e.g. long-term illness or family emergencies) must be approved by the professor.

Grading Policies

Students are evaluated based on their participation in class (both online and during lecture), responses to supplemental readings, performance on programming assignments, and both the execution and presentation of a group midterm and final project (which take the place of exams). If a particular grade is required in this class to satisfy any external criteria—including, but not limited to, employment opportunities, visa maintenance, scholarships, and financial aid—it is the student's responsibility to **earn** that grade by working consistently throughout the semester. Grades will not be changed based on student need, nor will extra credit opportunities be provided to an individual student without being made available to the entire class. **I encourage you to avoid thinking about points as things that can be passively lost on assignments, and instead as things that must be *actively earned* through concerted effort and demonstrated ability.**

The following breakdown will be used for determining the final course grade:

Course participation	10%
Reading responses	5%
Programming assignments	30%
2D Midterm Project	20%
3D Final Project	35%

I expect to use the following grading scale at the end of the semester. **You should not expect a curve to be applied.**

93 – 100	A
90 – 92	A-
88 – 89	B+
83 – 87	B
80 – 82	B-
78 – 79	C+
73 – 77	C
70 – 72	C-
60 – 69	D
<60	F

Art Contest

There are two different art contests in the class, held over the course of the semester. The first is the "accidental art" contest: sometimes in our efforts to perfectly render a well-thought-out scene, mistakes happen, and those mistakes look interesting! The second is the "actual art" contest, intended for students to submit intentional images or short videos from that strike them as particularly impressive or beautiful. There is a limit on the number of art contest entries: one per student per assignment. For group work, there should be at most two per group per project. At the end of the semester, we will all vote on our favorite art contest entries. The winner(s) will receive fame, glory, and extra credit **at the instructor's sole discretion**.

Special Accommodations

Students who have documented disabilities should contact me privately to discuss any specific needs and to agree upon a reasonable accommodation. Please see the campus Disability Resource Center for information on the kinds of accommodations available through the University.

Schedule

The schedule will be maintained on the course website, and any updates to it will be announced on Piazza.