

CS/ECE 412 Introduction to Computer Graphics: Scanline Algorithms Fall 2009

Instructor:

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Office Hours: by appointment

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TA office hours: Mon, Wed 2:00pm – 4:00pm in the AGL (ECE 218)

Class Location:

ECE Building, Room 310

Mondays & Wednesdays 11:00 – 12:15pm

Course Webpage:

http://www.ece.unm.edu/course/ece412

Important announcements, corrections and slides will be posted there. Get used to checking it often. We will also be adding an online forum to the website this year, which will be a good way for you to post questions, discuss project ideas, etc. with others.

Course Description:

This course is an introduction to computer graphics. No prior computer graphics knowledge is required, but students are supposed to be strong programmers since the assignments will require familiarity with C and C++. In this class we will be learning about 2-D and 3-D graphics, in particular as they relate to scanline rendering techniques as implemented in the OpenGL API. At the end of the semester, you will work on a video game that will be played on an Xbox 360 game console! Although this class will be a lot of work, many students that took it last year called it one of the best classes they have ever taken. This class (along with CS/ECE 413) is a pre-requisite for the rest of the graphics sequence here at UNM. However, the two introductory courses can be taken in either order.

Textbooks:

The following textbooks are required for the course:

Edward Angel. *Interactive Computer Graphics: A Top-Down Approach using OpenGL*, 5th Edition. Addison-Wesley, ISBN # 0-321-53586-3

D. Shreiner, M. Woo, J. Neider, T. Davis, *The OpenGL Programming Guide: The Official Guide to Learning OpenGL*, 6th Edition, Addison-Wesley, ISBN # 0-321-48100-3

These books should be available at the UNM bookstore. You can also get them from Amazon.com or your favorite online retailer. Readings will be assigned from this text as well as from class handouts and papers referenced from the web.

We will be using the textbooks for assigned readings and for reference. In addition, I will often assign the reading of technical papers, which I will post on the web rather than hand it out in class.

To view most papers you will need Adobe Acrobat and a web browser. We do this because papers available on the web are of better quality than what we can print out and distribute in class.

Pre-requisites:

Students are expected to be reasonably comfortable in programming in C or C++. Knowledge of linear algebra will be useful. Please ask me if you have questions about whether your background is suitable for this course.

Grading:

The best way to learn a subject like computer graphics is through a combination of homework assignments, projects, and exams that exercise and test different knowledge. In this class, we shall have homework assignments, a final project, two exams (mid-term and final) and several un-announced pop-quizzes to determine the final grade of each student. The weight of each as it contributes to the final grade is given below:

Homework	30%
Mid-Term	15%
Final project (XNA game)	35%
Final	15%
<u>Pop Quiz/Class participation</u>	<u>5%</u>
TOTAL:	100%

The homework assignments will be graded on a check, check-plus, check-minus system, where a check is assigned to a homework that meets most, if not all, functionality, a check-plus is a homework that is well implemented, and a check-minus is deficient in some respects. Class participation will be a subjective score based on the students' asking/answering questions in class as well as on the online forum. In particular, I will give extra credit in this category to students who go above and beyond on the online forum and answer a lot of questions. As far as is possible, the final letter grade will be assigned on a curve. I will do my best at the end of the semester to assign a fair letter grade to each student by comparing their final score to that of their peers.

Homework

There will be seven homework assignments in this class and they will total 30% of the final grade. Some of these assignments will involve written homework problems requiring calculations or explanations, while others will require significant programming. Written homework assignments must be submitted in person at the beginning of class on the day they are due. Programming assignments must be submitted electronically by midnight on the day that it is due. Any homework submitted after it has been collected it will be considered late. There is more discussion on the subject of late days in a later section of this syllabus.

Final Video Game Project

The final project for this class will be an XNA-based video game that will run on an XBOX console. You will have a little over a month to work on it and can work in teams of up to 2 students. On **December 10**, we will have the video game competition, which will consist of public viewing of all the games in the ECE atrium (anyone can play test your games) and then a presentation/awards session from 6 to 9pm. Prizes include gift certificates, video games, etc. The top games will be licensed by UNM and will be sold to the public through an online portal. Part of the proceeds from the sale of the games will go to the students who developed them. This means that your hard work can literally pay off in this class! I will give more details on the legal aspects of this as the project approaches. However, I would strongly recommend getting started with the XNA environment as soon as possible so that you are in full stride when the project is assigned.

Homework Submission and Late Days

As mentioned earlier, homework submitted after the deadline (beginning of class for written assignments, midnight for electronic assignments) will be considered late. For every day that the homework is late, it will be downgraded by a level in the check system. So a “check-plus” assignment will be downgraded to a “check” with one late day, downgraded to a “check-minus” with 2 late days, and be given no credit with three. The first “late day” is counted from the deadline to midnight of the next day, and from then on from midnight to midnight. For example, say a written homework assignment is due at the beginning of class on Wednesday. From that time to midnight on Thursday is late day #1, from 12:01 to midnight on Friday is late day#2, etc. So if the homework is submitted on Saturday, it is the third late day and 75% will be taken off. After four late days, the homework does not need to be submitted as it is now worth zero (no negative points).

I understand that things get busy during the semester and sometimes it is difficult to get everything done on time due to unforeseen circumstances. For this reason, each of **you will be provided with 5 “late days” to use at your discretion.** These late days push back your submission deadline without penalty. To use them, let me know before the deadline how many late days you plan on using. I ask that when you submit a written homework assignment late you slip it under my office door (225C) and send me an email at the same time so that I know you have submitted it. Use your late days wisely! Note that your late days cannot be used for the final project. Also, “incomplete” grades will not be issued for the course, so please get all your work done by the end of the semester.

Exams

There will be two exams: a mid-term and a final. The mid-term exam will be in class on **November 2, 2009** and test the material that is covered in the first half of the course. The final exam will be held on **December 16, 2009** from 10am – 12pm and will cover the entire course. Both exams will be paper and pencil only (no books, calculators, etc).

Assigned Reading

Inevitably, every semester I have students that complain that we did not use the course textbook despite the fact that I regularly assigned readings from the text. I guess many students feel like assigned readings are optional and that you don’t really have to do them, so many didn’t crack open the book the whole semester. To make sure that the reading is done, I will be testing your knowledge of the reading with a few pop-quizzes during the semester (see below).

Pop-quizzes

The pop-quizzes will be unannounced and will be held during the first five minutes of class. There are two main reasons for doing these quizzes. First, they will test students to see if they are keeping up with the material and the reading, and therefore help me judge how the class is progressing as a whole. Second, the pop-quizzes will help ensure attendance is relatively constant throughout the semester. Pop quizzes can be given on any material previously covered in the class, but I will probably focus on testing the assigned reading.

Since the pop-quizzes will be at the beginning of class, students who miss the first five minutes will receive a zero for that pop-quiz. Therefore, please e-mail me at least 3 hours before class time if you are going to be late or miss class. If you miss a pop-quiz but you have informed me in advance, the pop-quiz will not be counted when computing your final score.

These pop-quizzes are meant to keep you on your toes. I may give you many, or none. Don’t get lulled into a false sense of security. Do your reading ahead of time and keep up with the class material. Ask the TA or post your questions on the forum if there is something you don’t understand.

Collaboration

You may discuss problems with friends or on the forum, but working in groups on the homework assignments is not allowed. Do all your assignments and projects independently of others. If you discuss ideas with others, cite that in your work. Otherwise, working with others on an assignment is considered cheating.

Cheating

Cheating will not be tolerated in this class. If I suspect that you have cheated, you will receive an automatic 0 for the assignment and you will possibly also fail the course. Examples of cheating involve using somebody else's code or algorithm, artwork, etc without proper citation. Although I am not going to specifically look for this, I might occasionally compare people's code, so don't take the risk! Any case of cheating will be dealt with severely. I caught a few cheaters last year who were sharing code and their grades suffered as a consequence.

If you have questions about what constitutes cheating, please ask me. It is ok to look on the web for ideas on how to implement an algorithm, as long as you cite where you found that information. However, it is not ok to copy the algorithm! If you cannot get something to work and need to use somebody else's help, please cite that in both the code and in your writeup. It is important to know who contributed to what so that I can assign grades fairly.

Computer Lab

The Windows-based computers in ECE 211 are available for use by students in this class. They are fitted with NVIDIA GeForce FX5200 graphics cards. You are welcome to use these computers for your projects and assignments or if you want you can develop your code on any machine you wish (however, the final code must be able to run on these computers). I will often provide some skeleton code for the assignments for you to start with. This will be provided in Visual Studio, which is available on these machines. Of course, you can use other compilers and development systems, as long as your final source code can be compiled and run in Visual Studio. To get an account on these machines, please talk to the Computer Support staff in ECE 213 and 214.

Friendly Advice

Assignments in computer graphics can often take a lot of time. Don't get caught off guard and start well in advance. Talk to me or go to the TA's office hours if you have questions.

Questions/concerns?

Talk to me. We have a small class, so I want to hear your feedback through out the course. This will allow me to fine-tune the lectures to fill in things along the way.

ECE/CS 412 Course calendar

Here is what you will be learning this semester, day-by-day. Get ready for a fun semester!

Class	Date	Material	HW assigned	HW due
1	8/24 (M)	Overview of course, intro to computer graphics	HW 1	
2	8/26 (W)	How humans see: light, vision and color		
3	8/31 (M)	How cameras see: light fields and image formation	HW 2	HW 1
4	9/2 (W)	Introduction to signal processing		
	9/7 (M)	Labor Day Holiday		
5	9/9 (W)	Fourier Transforms and sampling/reconstruction		
6	9/14 (M)	Image-based graphics and computational photography	HW 3	HW 2
7	9/16 (W)	Matting and Compositing		
8	9/21 (M)	2-D graphics hardware and intro to 3-D graphics pipeline		
9	9/23 (W)	Representation of geometry		
10	9/28 (M)	Parametric representations and spline curves	HW 4	HW 3
11	9/30 (W)	2-D transformations		
12	10/5 (M)	3-D transformations		
13	10/7 (W)	Orthographic projection	HW 5	HW 4
14	10/12 (M)	Perspective projection		
15	10/14 (W)	Clipping and rasterization		
16	10/19 (M)	Rasterization		
17	10/21 (W)	Texture Mapping		
18	10/26 (M)	Texture Filtering	HW 6	HW 5
19	10/28 (W)	Graphics API's and Vertex and Fragment programs		
	11/2 (M)	Midterm exam (in class)		HW 6
20	11/4 (W)	Final Project / XNA Framework		
21	11/9 (M)	Cg and HLSL	HW 7	
22	11/11 (W)	Lighting Models: diffuse reflection		
23	11/16 (M)	Lighting Models: specular reflection and general BRDFs		
24	11/18 (W)	Hard shadow algorithms		
25	11/23 (M)	Soft shadow algorithms		
26	11/25 (W)	Bump mapping, environment maps and reflection		HW 7
27	11/30 (M)	Shading and other graphics effects		
28	12/2 (W)	Animation		
29	12/7 (M)	Final projects presentations, play testing		
	12/9 (W)	Development day (no class)		
	12/10 (Th)	Video game competition		
	12/16 (W)	Final exam (10AM – noon) in regular classroom		