Computer Science 333
Computer Graphics

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1 Subject Matter

Thirty or forty years ago, graphics was a specialty field within computer science, of interest only to developers of video games (at the low end) and powerful CAD/CAM packages (at the high end). But with the release of the Apple Macintosh and then Microsoft Windows, graphical user interfaces became common for computers at all levels. And the widespread availability of microcomputers and workstations with sufficient processing power has brought formerly high-end drafting, painting, simulation, and animation capabiilities within the reach of home and small-business users. The field of computer graphics has become mainstream, and an essential part of the training of a computer scientist.

This course will cover a wide range of topics within computer graphics, from both a mathematical and a practical point of view. Students are expected to be comfortable programming in the C or C++ language, and to have completed a course in linear algebra and matrices (although we'll review those topics briefly).

2 How to Learn Graphics

This is not a theoretical course; it is a very practical, hands-on course. To learn the stuff I expect you to learn, you *must* spend a lot of time on the computer *trying things*. Every time you read about a new OpenGL feature, or hear me describe one in lecture, *try it* in a program. *Invent* new ways to use it, beyond what I or the textbook have described. *Play* with it. Although I'll assign several specific graphics programs to write and turn in, I expect you to have written, debugged, run many more than that by the end of the semester, since that's the only way to check how much you *really* understand.

3 Texts

We'll use the textbook *Interactive Computer Graphics*, by Edward Angel, for reading and homework assignments. We'll get through approximately 350 pages of the text this semester, an average of 8 pages per class meeting. *Please* keep up on the reading! **You are responsible for everything in the reading assignments, whether or not I discuss it in a lecture.**

4 Grading

There will probably be three programming assignments, each worth about 20% of the semester grade; a larger programming project, worth about 30%; and a final exam worth about 10%.

Exams must be taken at the scheduled time, unless arranged in advance or prevented by a documented medical or family emergency. If you have three or more exams scheduled on the same date, or a religious holiday that conflicts with an exam or assignment due date, please notify me in writing within the first two weeks of the semester in order to receive due consideration. Exams not taken without one of the above excuses will get a grade of 0.

Programs are not abstract works of art, they are supposed to run and solve real problems. So if I get a program that doesn't compile or run, or a program that has little or nothing to do with the problem I assigned, I will give it a zero, no matter how much time you put into it. Don't bother turning in a program you haven't tested yourself.

5 Course Goals

By the end of this semester, you should be able to

- write and debug C++ programs that use external libraries such as OpenGL, GLU, GLUT, and GLEW
- write and debug programs to display 2-D and 3-D shapes using the OpenGL library
- discuss the advantages and disadvantages of doing various operations in the application, in a GPU-based vertex shader, and in a GPU-based fragment shader
- write simple programs in the GLSL language
- write event-driven interactive programs with callback functions and model/view separation
- represent rotation, reflection, translation, reflection, and skew operations as matrices (in 2-D, 3-D, or homogeneous-coordinates 4-D)

- perform dot-product and cross-product operations on vectors, and multiplication on matrices, and explain what they "mean" and why they're useful for 3-D computations
- describe a material's reflective qualities in terms of the Phong model, including what information each component of the model depends on
- write a substantial graphics software project involving event-handlers, surface and color effects, and 2-D display of 3-D virtual objects

6 Ethics

The Adelphi University Code of Ethics applies to this course. Look it up on the Web at http://academics.adelphi.edu/policies/ethics.php .

Programming assignments and projects may be done individually or by teams of two (2) students. You *may not work with the same partner more than once.* Other than your current partner, you may *discuss general approaches* to a problem with classmates, and you may *copy a few lines, with attribution*, from either the textbook, my examples, or your classmates, but I expect the majority of each program you turn in to be your own work.

All work on an exam must be entirely the work of the one person whose name is at the top of the page. If I have evidence that one student copied from another on an exam, *both* students will be penalized.

7 Schedule

This class meets every Monday, Wednesday, and Friday from 9:00-9:50 AM, except on University holidays or if I cancel class. All dates in the schedule of topics are tentative, except those fixed by the University; if some topic listed here as taking one lecture in fact takes two lectures to cover adequately, or *vice versa*, the schedule will shift, and I'll try to keep the Web page updated.

All reading assignments are from the Angel textbook unless stated otherwise. Many of them are Powerpoint lectures that Dr. Angel provided to go along with his textbook. We can go through these in class if you wish, but things will be more efficient if you read the text and the slides in advance and come in with specific questions; this way I can concentrate my time on answering questions and clarifying subtle or difficult points in the textbook, rather than on reading to you, which will bore both of us. **Please read ahead!**