Course Information

1 Staff

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World Wide Web: http://stellar.mit.edu/S/course/6/sp07/6.839

2 Information

Advanced computer graphics will teach you how to represent geometry, motion, and appearance in complex three-dimensional scenes. Upon conclusion of this course, you will know how to apply computational methods to represent any scene, real or imagined. You will know how to analyze research publications in computer graphics. And you will know how to combine these methods to solve new challenges in computer graphics. We hope to inspire passion for computer graphics and its many applications, instill fearlessness needed to implement even the most sophisticated computational methods, and encourage lifelong learning from research publications.

3 Prerequisites

A strong understanding of programming and a solid background in linear algebra and multivariable calculus are necessary prerequisites to this course. You are expected to have taken Linear Algebra (18.006 or equivalent), Introduction to Algorithms (6.046J or equivalent). A computer graphics course such as 6.837 is strongly recommended for undergraduates. Advanced undergraduates and all graduate students need not have taken such a course in the past. If you do not meet these requirements, arrange to talk with the instructor.
4 Course Website

Please bookmark the course website:

http://courses.csail.mit.edu/6.839

This link will take you automatically to the Stellar Web site:

http://stellar.mit.edu/S/course/6/sp07/6.839,

which will contain electronic copies of handouts, assignments, and special announcements. Visit this site regularly to be aware of any changes in the course schedule, updates to your instructors’ office hours, etc. Major announcements will also be emailed to everyone in the class.

5 Topics

The detailed schedule for the course is available on the Web. These topics are divided into five parts:

Fundamentals. We review the basics of linear algebra (linear transformations, change of bases, eigenanalysis and singular value decomposition) in the context of concrete computer graphics problems.

Geometry. We derive subdivision curves and surfaces with a general and constructive approach. We also explore variational descriptions of non-rigid geometry and its control via inverse problems.

Global Illumination. We formulate a general rendering equation for light transport and examine numerical solutions with Monte Carlo integration (stochastic ray tracing) and finite-element methods (radiosity).

Motion. We formulate classical dynamics of constrained particles and rigid bodies and examine computational methods for efficient simulation and control.

Publications. We analyze academic publications in computer graphics. For example, we review data-driven graphics and its fundamentals: memory-based learning and regression. We will also select additional topics according to student interest.

6 Lectures

Students are responsible for all material presented in the course. There are no required textbooks for this class. Students are expected to learn the material from lectures, readings, and handouts. All handouts will be available on the course web page in formats suitable for printing. The students should also take their own notes as lectures will often depend on the blackboard to convey the details and the information that is not adequately covered in other course material. Lectures will be held in Room 32–144 from 11 A.M. to 12:30 P.M. EST on Tuesdays and Thursdays.
Students without prior computer graphics experience will benefit from two more resources. The first book is *3D Computer Graphics: A Mathematical Introduction with OpenGL* by Samuel R. Buss. You do not need to purchase a hardcopy version of this book. There is a free online version available from Books24x7 (http://libraries.mit.edu/get/books24x7, you will need your MIT Personal Certificate). The book also has an associated web page that contains sample code and known errata. The second book is *The OpenGL Programming Guide* (also known as the red book). An earlier edition of this book (1.1) is available for free on the Web http://www.opengl.org/documentation/red_book_1.0/. The latest edition (1.4) is not available online, but everything that we will need in this course is addressed in the first edition.

### 7 Assignments and Basics

The course will include four graded (three assignments and a bonus) and several ungraded homeworks (basics). The basics develop the material that’s best learned through programming and implementation. They are a prerequisite for successful completion of graded homeworks. The assignments are more involved and require synthesis of more than one class topic. The bonus problem is the hardest homework and it extends one of the three assignments in interesting ways.

The course calendar shows tentative schedule of homework due dates. On that date you will turn in the homework and demonstrate a working version of your program. We will go through this process for both basics and assignments to provide feedback and clarify grading process for the bonus and assignments. Each student will also present their bonus at the end of the semester with short, ten minute presentations.

Late homeworks will receive no credit. If there are extenuating circumstances, you should make prior arrangements with the instructor. An excuse from the Dean’s Office will be required if prior arrangements have not been made. You are responsible for ensuring that the correct solution is uploaded on time. For example, you might want to assume that the deadline is two hours before the posted time to ensure that the Web server is not overloaded when you attempt to upload your solution.

### 8 Grading Policy

The final grade will depend on the three graded assignments (60%), the graded bonus (10%), class participation (10%), and the final exam (20%). The grade for class participation will depend on your attendance, participation, and the discussion of reading materials in the course forum. Note that you cannot earn a top grade without completing the bonus and participating in the class.

### 9 Collaboration Policy

Collaboration on homeworks is encouraged, but you must write *all* solutions and programs on your own. If you are stuck and not able to make progress you should contact the instructor and the teaching assistant during the office hours. If you collaborate with others on any part of the homework, you should identify your collaborators by name. If you did not collaborate with anyone
then you should explicitly state so. If you obtain a solution through research (e.g., on the Web), cite the source, but write the solution or code on your own. For example, if you cannot explain the solution to a member of the course staff then you have violated our collaboration policy.

Collaboration is not permitted on the final exam. Students in violation of this collaboration policy will receive no credit for the assignment or exam and their actions will be reported to the Committee on Discipline. If you have any doubt about this collaboration policy, you should talk to the instructor immediately. If you’d like to learn more about academic integrity and the MIT policy, you can consult the MIT handbook for students


and the MIT libraries guide to avoiding plagiarism

http://libraries.mit.edu/tutorials/general/plagiarism.html