CS 481/681 - Topics in Computer Graphics

Meets MWF 1-2 PM Room 104 Chapman Building University of Alaska Fairbanks	CS F481-F01 (#32850) / 681 (#32858) 3.0 Credits, Spring 2005 Prerequisite: CS 381 (Intro to CG)	Instructor: Dr. O. Lawlor ffosl@uaf.edu, 474-7678 Office: 210C Chapman, 2-4 MWF

	Recommended Textbook: Interactive Computer Graphics, by Edward Angel, Addison-Wesley	ADA Compliance: Will work with Office of Disabilities Services (203 WHIT, 474-7043) to provide reasonable accomodation to students with disabilities.	Course Website (& links to Blackboard): http://www.cs.uaf.edu/2005/cs481/ Graphics Lab Machines with Fast, Capable Graphics Cards: TBA

Course Goals and Requirements

This course will cover a broad selection of advanced computer graphics topics, from texturing and procedural shading to accurate rendering and shadowing. To understand this, you will need to have experience writing interactive graphics programs, including working with vectors, matrices, cameras, and polygons under at least one modern graphics API, such as OpenGL or DirectX.

Grading

Your work will be evaluated on correctness, rationale, and insight, not on successful regurgitation of random trivia. Grades for each assignment and test may be curved upward, by scaling to a distribution with a median of at least 80%. Each homework and the midterm will then be clamped to the range [0%,100%]. Your grade is then computed based on four categories of work:

1. **HOMEWORK**: Very short, simple machine problems designed to demonstrate the basics of each technique. Will normally be assigned once every two weeks.
2. **PROJECTS:** Two short individual or group semester projects. I'll provide a list of possible topics, let you pick groups and a topic, and provide a staged series of requirements, including (1) project description, (2) informal project design, (3) code, and (4) a short presentation.
3. **MT:** Midterm Exam covering the hardware section, tentatively held Wednesday, March 9 at the usual class time.
4. **FINAL:** Final Exam covering the high-quality graphics section, to be held Wednesday May 11 at 1PM.

Your final score is calculated as:

TOTAL = 20% **HOMEWORK** + 20% **PROJECTS** + 30% **MT** + 30% **FINAL**

Those in the graduate section (681) will be expected to turn in more sophisticated projects, and will have extra questions on the midterm and final.

Assignments will be due at the beginning of class. Late work will not be accepted under any circumstances. Exams must be taken as scheduled, except in extreme circumstances. Academic dishonesty (including plagarism or cheating) is unacceptable and will be handled according to University board regulations.

Course Outline and Schedule (Tentative)

High Speed Rendering

- Advanced Textures
  - Mipmapping
  - Anisotropic texture filtering
  - 3D (solid) texturing
  - Multitexture
- Pixel/Fragment Shaders
  - Basics
  - ARB_FRAGMENT_PROGRAM
  - Dependent textures
  - Higher-level languages
- Shadow Computation
  - Shadow maps
  - Shadow volumes
- If time and interest warrant: Geometry processing
  - Large-scale terrain decimation

Calendar	Monday	Wednesday	Friday
January			21 First day of class
Textures	24	26 PROJ1 Topic Due	28 Add Deadline
-	31		
February		2 PROJ1 Design Due	4 Drop Deadline

- Subdivision surfaces & adaptive refinement

High Quality Rendering

- Raytracing
  - Raytracing basics
  - Raytracing accelleration via bounding volumes
  - Soft raytracing via multisampling
  - Soft raytracing via cone tracing
- Radiometry
  - Terminology: luminance, irradiance
  - Surface-to-surface rendering equation
  - Radiosity & Global Illumination
- Volume Rendering
  - Ray marching
  - Splatting and shear-warp
  - Discrete ordinates radiation transport
- If time and interest warrant: Camera calibration
  - Geometric calibration (camera matrix, radial distortion)
  - Radiometric calibration (gamma correction, aperture compensation)
  - High dynamic range imagery
  - Integration of synthetic and real imagery

Pixel Shaders	7	9	11
-	14	16	18
Shadows	21	23	25
-	28		
March		2 PROJ1 Due	4
Review and Midterm	7	9 MIDTERM	11
Spring Break	14 (BREAK)	16 (BREAK)	18 (BREAK)
Raytracing	21 Last day to Withdraw	23 PROJ2 Topic Due	25
-	28	30	
April			1
Radiometry	4	6 PROJ2 Design Due	8
-	11	13	15
Volume Rendering	18	20	22
-	25	27 PROJ2 Due	29 (BREAK) Springfest
May			
Semester Project Demos	2 PROJECT Demos	4 PROJECT Demos	6 Review for final exam
Finals Week	9 (NO CLASS)	11 FINAL at 1PM	