Syllabus for CSE170: Computer Graphics

Spring 2010
Instructor: Marcelo Kallmann

Designation: CSE170 Computer Graphics
Catalog Description: Basic algorithms in computer graphics enabling students to understand and experience the process of implementing modern computer graphics applications. Topics covered: rasterization, clipping, hidden surface removal, transformations, rendering pipeline, scene graphs, curves and surfaces, constructive solid geometry, boundary representation, spatial partition methods, texture mapping, color models, illumination and shading.


Course Objectives/Student Learning Outcomes: This course introduces 1) the basic algorithms used in 3D Application Programming Interfaces (APIs) such as OpenGL and DirectX, which are now implemented in practically all graphics cards available in computer systems from high-performance machines to personal computers, and 2) the basic modeling techniques implemented in modern specialized modeling and animation packages such as 3DS Max, Maya and Auto CAD.

The course focuses both on the theoretical and practical implementation side of the algorithms and the goal is to provide students with solid foundations for addressing a wide variety of computational problems in computer graphics and to provide a thorough knowledge of the most common algorithms and techniques.

Prerequisites by Topic: Class Prerequisite: CSE 030: Introduction to Computer Science and Engineering I, Proficient level of programming skills in C and C++ and as well basic knowledge of data structures. Prior knowledge of OpenGL is desired but not required.

Course Policies: The course is to be organized in about 2h of lectures and two lab sessions per week. While the lectures introduce the covered topics, the students perform several programming assignments during the lab sessions in order to fully understand and practice using the several algorithms and techniques discussed.

About 8 programming assignments are introduced and developed during the lab sessions. Optional assignments are also provided as a mechanism for students to improve their grades when needed. The assignments are organized in a way to cover all important topics and to provide the basic pieces for the students to be able to implement two larger projects, one focusing on hierarchical transformations, and a final project where the students can choose among several topics in computer graphics to implement. The final grade is computed by the average points obtained in: two exams, the several programming assignments, and the two projects. This learning-by-experience format has proven to be very effective in the latest offering of this course, indicating that extensive programming practice is essential for the understanding of the covered topics.

Academic Dishonesty Statement: a. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this
course for academic credit will be the student's own work.
b. You are encouraged to study together and to discuss information and concepts
covered in lecture and the sections with other students. You can give "consulting"
help to or receive "consulting" help from such students. However, this permissible
cooporation should never involve one student having possession of a copy of all
or part of work done by someone else, in the form of an e mail, an e mail
attachment file, a diskette, or a hard copy. Should copying occur, both the student
who copied work from another student and the student who gave material to be
copied will both automatically receive a zero for the assignment. Penalty for
violation of this Policy can also be extended to include failure of the course and
University disciplinary action.
c. During examinations, you must do your own work. Talking or discussion is not
permitted during the examinations, nor may you compare papers, copy from
others, or collaborate in any way. Any collaborative behavior during the
examinations will result in failure of the exam, and may lead to failure of the
course and University disciplinary action.

Disability Statement:

Accommodations for Students with Disabilities: The University of California
Merced is committed to ensuring equal academic opportunities and inclusion for
students with disabilities based on the principles of independent living, accessible
universal design and diversity. I am available to discuss appropriate academic
accommodations that may be required for student with disabilities. Requests for
academic accommodations are to be made during the first three weeks of the
semester, except for unusual circumstances. Students are encouraged to register
with Disability Services Center to verify their eligibility for appropriate
accommodations.

Topics:

Rasterization, clipping, hidden surface removal, transformations, rendering
pipeline, scene graphs, graphics libraries, interpolation, curves and surfaces,
constructive solid geometry, boundary representation, spatial partition methods,
texture mapping, color models, illumination and shading, and quick overview of
selected advanced topics in computer animation, motion planning and GPU
programming.

Class/laboratory
Schedule:

2h of lectures and two 3h lab sessions per week to be scheduled

Midterm/Final Exam
Schedule:

Midterm by week 7
Final exam by week 15

Course Calendar:

(week number; topics; programming assignments; and book readings)
1 Rendering Pipeline; PA1:2d-drawing; Chapter 1
2 Transformation Matrices; PA2:wire tube; Chapters 5-6
3 Transformations, Scene Graphs; PA3:stopwatch; Section 7.1
4 Barycentric Coordinatess, Color; PA4:smooth tube; Chapter 11, Sections
14.1-14.2
5 Illumination, Shading; PA5:view mesh; Chapter 13,
6 Textures, Rasterization; Project 1; Sections 14.3
7 Clipping, Ray Tracing; Midterm Exam; Sections 3.9-3.11
8 Parametric and Implicit curves; Project 2; Sections 10.3-10.4
9 Lagrange, Hermite, Bézier curves; PA6:lagrange & Béziers; Section 9.2
10 B-Splines, Interpolating Splines; PA7:B-Splines; Section 9.2
11 Topics in Animation; PA8(optional):Int. Splines
12 Euler Formula and Manifolds; PA9(optional):Bézier Patch; Chapter 10
13 BRep Structures, Euler Operators; PA10(optional):Marching Sq.; Chapter 10
14 Modeling by Decomposition, CSG; PA11(optional):Sphere LOD
15 Subdivision Surfaces and review; Final exam
Professional Component:
Assessment/Grading Policy:
35% Exams: two exams (midterm and final)
30% Projects: two projects (one focusing on transformations and a final project with open topic)
35% Programming Assignments: around 8 assignments covering the most important topics seen in lecture.

Coordinator: Marcelo Kallmann
Contact Information: 
Office Hours: 