Syllabus of CS174A: Introduction to Computer Graphics (Winter 2024)

Instructors & TAs

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Role	Instructor	TA	TA
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Class Location	Boelter 3400	Haines A25, Rolfe 3126	PUB AFF 2250, Royce 162
Class Hours	TR 6-8 PM	F Noon-2 PM, F 2-4 PM	F Noon-2 PM, F 2-4 PM
Office Location	Classroom	Zoom	Zoom
Office Hours	TR 8:00-8:30PM	R 2-4 PM	T 1-3 PM

Main E-Textbook (Optional)

Pearson eText Interactive Computer Graphics -- Access Card (Edition 8e); ISBN: 978-0135258262

Summary

This course introduces the fundamental principles of Computer Graphics (CG). The lectures will divide their focus between the mathematical foundations of computer graphics, and hands-on programming. The same goes for Friday TA discussions, which will additionally involve Q&A. A major goal of the course is to acquire better programming skills and tooling, so prepare to do heavy programming. We will explore web browsers' developer tools, fault diagnosis, etc.

The course will adopt innovative ways to enhance student learning and engagement, especially using PBL methodology (Project Based Learning) where you will propose your favorite computer graphics project and execute under the mentorship of TAs. Projects will be peer evaluated, using flipped-classroom and gamification paradigms; this will further increase student engagement. You will learn not only from your own project, but will also provide critical and motivational assessment to your peers' projects.

We will use Canvas Discussions for class discussions, questions, and participation; Canvas will be your primary mode of communication with the TAs, I and each other.

Getting Information

Class Website: https://bruinlearn.ucla.edu/courses/176723

Grading Scheme

There are **500** points available in this class:

- **Midterm: 100 points (20%)**
- **Final: 150 points (30%)**
- **Quizzes: 25 points (5%)**
- **Assignments: 75 points (15%)**
  There will be 4 preliminary assignments, totaling **75** points, starting with a simple one (**0 points**) for getting your environment setup and working. The rest 3 assignments (**25 points each**) will ask you to demonstrate concepts progressively covered in class.
- **Final Team Project: 150 points (30%)**
  Preliminary proposal: 5%; final proposal + midway evaluation: 5%; final demo + report: 15%; peer evaluation: 5%
  The end of the class centers around a team project of 3 to 4 members. Your team can create whatever they like for your project as long as it is primarily an interactive, graphics-based application. It will be evaluated based on originality, technical impressiveness, and creativity. The team project is due at the end of last week of class. Live, final presentations will take place during last week in randomized order. All members must present.

Curving final grades up or down is not ruled out, if needed to move the distribution so that grades are not too uniform or too low. Besides that, final grades will be awarded as follows:
D-: 60%+, D: 63%+, D+: 67%+,
C-: 70%+, C: 73%+, C+: 77%+,
B-: 80%+, B: 83%+, B+: 87%+,
A-: 90%+, A: 93%+, A+: 97%+

PNP option: https://www.seasoasa.ucla.edu/deadlines-enrollment-policies/

Policy

Group work is not permitted until specified. Re-use of code from other students is prohibited. Usage of outside resources and libraries must be explicitly disclosed, when allowed. Refer to Section 102.01 of the UCLA Student Conduct Code. Any dishonesty will be referred to the Office of Student Conduct and receive zero credit.

Topics Covered

Graphics Pipeline, Modeling Transformations, Viewing Transformation, Projections, Polygonal Representations and Modeling Hierarchies, Local and Global Illumination, Texture Mapping, Ray Tracing, Particle & Volume Rendering.

Schedule (Winter 2024)

Week#	Date	Topics	Book Sections	Notes
01	Jan 9	Class / assignment overview, state of graphics field, graphics history, applications	1.1	
	Jan 11	Graphics program anatomy Linear Algebra Review, Vector math	1.2, 4.1.1 3.3, 3.4	
02	Jan 16	Linear Algebra (contd.): vectors and matrices	4.1, 4.3.1, 4.5	
	Jan 18	Coordinate Systems, Polygons, Interpolation	2.4.1, 4.3.0-4.3.1, 4.2	
03	Jan 21	A1 due		**A1**: Env setup, Chrome dev tools
	Jan 23	Vertex Arrays, Indexing, Matrix transformations, Hierarchies	4.6.0-4.6.3 4.7-4.9	
	Jan 25	Change of Basis, Concatenating of Transformations, Graphics Pipeline	4.3.2, 4.10	
04	Jan 30	Concatenations (contd.), Projections, Viewing, View Volumes	5.0, 5.1.0, 5.1.1, 5.1.2, 5.1.5, 5.2, 5.3	
	Feb 1	Normalized projections, window-to-viewport mapping	5.4.0-5.4.4, 5.5, 5.6, 5.7	
05	Feb 4	A2 due		**A2**: Tilting Boxes
	Feb 6	Geometrical calculations, midterm review		
	Feb 8	**MIDTERM**: closed notes/books/electronics		During class hours, in person
06	Feb 13	HSR Algorithms: Painter's, Z-Buffer, Scanline Z-Buffer	5.8, 12.5, 12.6	
	Feb 15	Lighting/Illumination: Ambient, Diffuse, Specular	6.0-6.4	
07	Feb 20	Flat vs Smooth Shading, Barycentric coordinates, Interpolation	6.5	
	Feb 22	Non-photorealistic rendering, Global illumination (Radiosity, Ray Casting) Mappings: Texture, Bump, Displacement, Environment Shadows: 2-pass z-buffer, shadow volumes	6.11, 6.12, 7.0-7.8 5.10, 5.11	
08	Feb 25	A3 due		**A3**: Solar system, illumination, shading
	Feb 27	Project proposal, peer evaluations Ray Casting	13.2	
	Feb 28	Project proposals due: initial version		**Team Project**
	Feb 29	Ray Tracing, Stochastic RT	13.3	
	Mar 1	Team project midway demos		TA discussion sessions
09	Mar 3	A4 due		**A4**: Textures
	Mar 5	Alpha Blending, Particle Rendering	10.0, 10.1, 10.2, 10.5, 10.6, 10.8	
	Mar 7	Prof Demetri: Biometric Human Simulation		
	Mar 7	Online evaluations open (8 AM)		
10	Mar 12	Volume Rendering, Aliasing/Anti-Aliasing	13.9, 13.10, 13.13, 12.8	
	Mar 13	Project proposals due: final version		**Team Project**
	Mar 14	Final exam review, final demo instructions		
	Mar 15	Team project final demos		TA discussion sessions Project code due
	Mar 16	Online evaluations close (8 AM)		
Finals	Mar 19	**FINAL EXAM:** closed notes/books/electronics		6:30-8:30 PM, in person, in class; Location: TBD