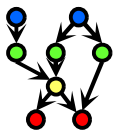


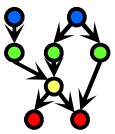
Lecture 0 of 41:
Part A – Course Organization

Introduction to Computer Graphics: Course Organization and Survey

William H. Hsu
Department of Computing and Information Sciences, KSU

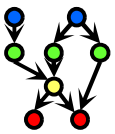
KSOL course page: http://bit.ly/hGvXlH
Course web site: http://www.kddresearch.org/Courses/CIS636
Instructor home page: http://www.cis.ksu.edu/~bhsu

Reading for Next Class:
Syllabus and Introductory Handouts
CIS 536 & CIS 636 students: *CG Basics 1* slides
Chapter 1, Eberly (2006) *3D Game Engine Design, 2e*



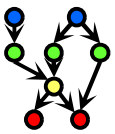
Course Administration

- Course Pages (KSOL): http://bit.ly/hGvXlH / http://bit.ly/eVizrE
- Class Web Page: www.kddresearch.org/Courses/CIS636
- Instructional E-Mail Addresses – Best Way to Reach Instructor
  - CIS736TA-L@listserv.ksu.edu (always use this to reach instructor and TA)
  - CIS636-L@listserv.ksu.edu (everyone; substitute "736" for Advanced CG)
- Instructor: William Hsu, Nichols 324C
  - Google Voice (cell/office/home): +1 785 236 8247; office: +1 785 532 7905
  - IM: AIM/MSN/YIM hsuwh/rizanabsith, ICQ 28651394/191317559, Google banazir
  - Office hours: after class Mon/Wed/Fri; Tue AM; other times by appointment
- Graduate Teaching Assistant: To Be Announced
  - Office location: Nichols 124 (CIS Visualization Lab) & Nichols 218
  - Office hours: to be announced on class web board
- Grading Policy: Overview
  - Exams: 45%
  - Homework: 23% (5 written, 5 programming, drop lowest 2; 7 labs)
  - Term project: 20%
  - Paper/peer reviews and class participation: 12% (Q&A)



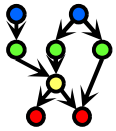
Course Policies

- Letter Grades
  - 15% graduations (85+%: A, 70+%: B, etc.)
  - Cutoffs may be more lenient, but a) never higher and b) seldom much lower
- Grading Policy
  - Hour exams: 10% each (in-class, with notes); final (open-book): 25%
  - Machine problems, problem sets (8 of 10): 16%; labs: 7%; term project: 20%
  - Reviews: paper critiques (2): 4%; peer review: 2%
  - Class participation: 6% (HW, Q&A)
- Late Homework Policy
  - Allowed only in case of medical excusal
  - All other late homework: see drop policy
- Attendance Policy
  - Absence due to travel or personal reasons: e-mail CIS736TA-L in advance
  - See instructor, Office of the Dean of Student Life as needed
- Honor System Policy: http://www.ksu.edu/honor/
  - On plagiarism: cite sources, use quotes if verbatim, includes textbooks
  - OK to *discuss* work, but turn in your own work only
  - When in doubt, ask instructor

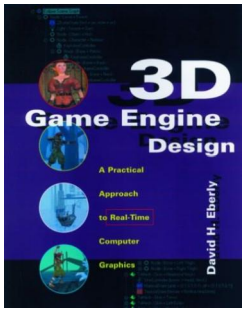


Class Resources

- Course Content Management System (CMS): K-State Online (KSOL)
  - Official course page: http://bit.ly/hGvXlH
  - Mirror: http://www.kddresearch.org/Courses/CIS636
  - Lecture notes (MS PowerPoint 97-2010, PDF)
  - Homeworks (MS Word 97-2010, PDF)
  - Exam and homework solutions (MS PowerPoint 97-2010, PDF)
  - Class announcements (students' responsibility) and grade postings
- Course Notes On KSOL and Public Mirror
- Mailing List (Automatic): CIS636-L@listserv.ksu.edu
  - Homework/exams (before uploading to CMS, KSOL), sample data, solutions
  - Use KSOL "File Dropbox"
  - Class participation
  - Project info, course calendar reminders
  - Dated research announcements (seminars, conferences, calls for papers)
- LISTSERV Web Archive
  - http://listserv.ksu.edu/archives/cis636-l.html
  - Stores e-mails to class mailing list as browsable/searchable posts

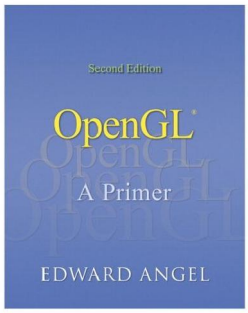


Textbook and Recommended References

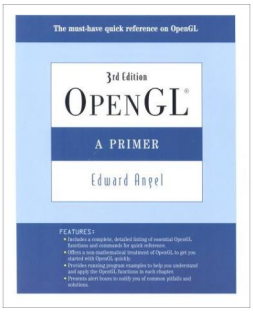


1st edition (outdated)

2nd edition



2nd edition (OK to use)



3rd edition

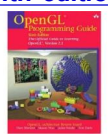
Required Textbook

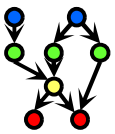
Eberly, D. H. (2006). *3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics, second edition.* San Francisco, CA: Morgan Kauffman.

Recommended References

Angel, E. O. (2007). *OpenGL: A Primer, third edition.* Reading, MA: Addison-Wesley. [2nd edition on reserve]

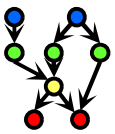
Shreiner, D., Woo, M., Neider, J., & Davis, T. (2009). *OpenGL® Programming Guide: The Official Guide to Learning OpenGL®, Versions 3.0 and 3.1, seventh edition.* ["The Red Book": use 7th ed. or later]





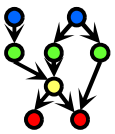
Background Expected

- **Both Courses**
  - Proficiency in C/C++ or *strong* proficiency in Java and ability to learn
  - Strongly recommended: matrix theory or linear algebra (e.g., Math 551)
  - At least 120 hours for semester (up to 150 depending on term project)
  - Textbook: *3D Game Engine Design*, *Second Edition* (2006), Eberly
  - Angel's *OpenGL: A Primer* recommended
- **CIS 636 *Introduction to Computer Graphics***
  - Fresh background in precalculus: Algebra 1-2, Analytic Geometry
  - Linear algebra basics: matrices, linear bases, vector spaces
  - Watch background lectures
- **CIS 736 *Computer Graphics***
  - Recommended: first course in graphics (background lectures as needed)
  - OpenGL experience helps
  - Read up on shaders and shading languages
  - Watch advanced topics lectures; see list before choosing project topic



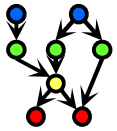
Online Recorded Lectures for CIS 536/636 (Intro to CG)

- Project Topics for CIS 536/636
- Computer Graphics Basics (10)
  - 1. Mathematical Foundations – Week 1 - 2
  - 2. OpenGL Primer 1 of 3: Basic Primitives and 3-D – Weeks 2-3
  - 3. Detailed Introduction to Projections and 3-D Viewing – Week 3
  - 4. Fixed-Function Graphics Pipeline – Weeks 3-4
  - 5. Rasterizing (Lines, Polygons, Circles, Ellipses) and Clipping – Week 4
  - 6. Lighting and Shading – Week 5
  - 7. OpenGL Primer 2 of 3: Boundaries (Meshes), Transformations – Weeks 5-6
  - 8. Texture Mapping – Week 6
  - 9. OpenGL Primer 3 of 3: Shading and Texturing, VBOs – Weeks 6-7
  - 10. Visible Surface Determination – Week 8
- Recommended Background Reading for CIS 636
- Shared Lectures with CIS 736 (*Computer Graphics*)
  - Regular in-class lectures (30) and labs (7)
  - Guidelines for paper reviews – Week 6
  - Preparing term project presentations, CG demos – Weeks 11-12



Online Recorded Lectures for CIS 736 (Computer Graphics)

- Project Topics for CIS 736
- Advanced Topics in Computer Graphics (10)
  - 1. Filters for Texturing – Week 2
  - 2. Level-of-Detail Algorithms and Terrain – Week 3
  - 3. More Mappings – Week 6
  - 4. More on Animation – Week 8
  - 5. Character Modeling and IK – Week 9
  - 6. Global Illumination: Photon Maps (Radiosity) – Week 10
  - 7. Advanced Lighting Models – Week 11
  - 8. Advanced Ray-Tracing – Week 12
  - 9. More on Scientific, Data, Info Visualization – Week 13
  - 10. Fractals and L-Systems – Week 14
- Recommended Background Reading for CIS 736
- Shared Lectures with CIS 536/636 (*Introduction to Computer Graphics*)
  - Regular in-class lectures (30) and labs (7)
  - Guidelines for paper reviews – Week 6
  - Preparing term project presentations, CG demos – Weeks 11-12



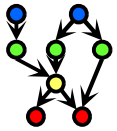
Syllabus [1]: First Half of Course

Lecture	Topic	Primary Source(s)
0	Course Overview	Chapter 1, Eberly 2e
1	**CG Basics: Transformation Matrices; Lab 0**	**Sections (§) 2.1, 2.2**
2	Viewing 1: Overview, Projections	§ 2.2.3 – 2.2.4, 2.8
3	Viewing 2: Viewing Transformation	§ 2.3 esp. 2.3.4; FVFH slides
4	**Lab 1a: Flash & OpenGL Basics**	**Ch. 2, 16[1], Angel *Primer***
5	Viewing 3: Graphics Pipeline	§ 2.3 esp. 2.3.7; 2.6, 2.7
6	Scan Conversion 1: Lines, Midpoint Algorithm	§ 2.5.1, 3.1; FVFH slides
7	**Viewing 4: Clipping & Culling; Lab 1b**	**§ 2.3.5, 2.4, 3.1.3**
8	Scan Conversion 2: Polygons, Clipping Intro	§ 2.4, 2.5 esp. 2.5.4, 3.1.6
9	Surface Detail 1: Illumination & Shading	§ 2.5, 2.6.1 – 2.6.2, 4.3.2, 20.2
10	**Lab 2a: Direct3D / DirectX Intro**	**§ 2.7, Direct3D handout**
11	Surface Detail 2: Textures; OpenGL Shading	§ 2.6.3, 20.3 – 20.4, *Primer*
12	Surface Detail 3: Mappings; OpenGL Textures	§ 20.5 – 20.13
13	**Surface Detail 4: Pixel/Vertex Shad.; Lab 2b**	**§ 3.1**
14	Surface Detail 5: Direct3D Shading; OGLSL	§ 3.2 – 3.4, Direct3D handout
15	Demos 1: CGA, Fun; Scene Graphs: State	§ 4.1 – 4.3, **CGA handout**
16	**Lab 3a: Shading & Transparency**	**§ 2.6, 20.1, *Primer***
17	**Animation 1: Basics, Keyframes; HW/Exam**	**§ 5.1 – 5.2**
	Exam 1 review; Hour Exam 1 (evening)	**Chapters 1 – 4, 20**
18	**Scene Graphs: Rendering; Lab 3b: Shader**	**§ 4.4 – 4.7**
19	**Demos 2: SFX; Skinning, Morphing**	**§ 5.3 – 5.5, CGA handout**
20	Demos 3: Surfaces; B-reps/Volume Graphics	§ 10.4, 12.7, **Mesh handout**

Lightly-shaded entries denote the due date of a written problem set; heavily-shaded entries, that of a machine problem (programming assignment); blue-shaded entries, that of a paper review; and the green-shaded entry, that of the term project.

Lab exercises are always due on the day before the next lab.

Green, **blue** and **red** letters denote **exam review**, **exam**, and **exam solution review** dates.



Syllabus [2]: Second Half of Course

21	**Lab 4a: Animation Basics**	**Flash animation handout**
22	Animation 2: Rotations; Dynamics, Kinematics	Chapter 17, esp. §17.1 – 17.2
23	Demos 4: Modeling & Simulation; Rotations	Chapter 10[1], 13[2], §17.3 – 17.5
24	**Collisions 1: axes, OBBs, Lab 4b**	**§2.4.3, 8.1, GL handout**
25	Spatial Sorting: Binary Space Partitioning	Chapter 6, esp. §6.1
26	**Demos 5: More CGA; Picking; HW/Exam**	**Chapter 7[2]; § 8.4**
27	**Lab 5a: Interaction Handling**	**§ 8.3 – 8.4; 4.2, 5.0, 5.6, 9.1**
28	Collisions 2: Dynamic, Particle Systems	§ 9.1, particle system handout
	Exam 2 review; Hour Exam 2 (evening)	**Chapters 5 – 6, 7[2] – 8, 12, 17**
29	**Lab 5b: Particle Systems**	**Particle system handout**
30	**Animation 3: Control & IK**	**§ 5.3, CGA handout**
31	Ray Tracing 1: intersections, ray trees	Chapter 14
32	Lab 6a: Ray Tracing Basics with POV-Ray	RT handout
33	Ray Tracing 2: advanced topic survey	Chapter 15, **RT handout**
34	Visualization 1: Data (Quantities & Evidence)	Tufte handout (1)
35	**Lab 6b: More Ray Tracing**	**RT handout**
36	Visualization 2: Objects	Tufte handout (2 & 4)
37	Color Basics; Term Project Prep	**Color handout**
38	Lab 7: Fractals & Terrain Generation	**Fractals/Terrain handout**
39	**Visualization 3: Processes; Final Review 1**	Tufte handout (3)
40	**Project presentations 1; Final Review 2**	–
41	Project presentations 2	–
	Final Exam	**Ch. 1 – 8, 10 – 15, 17, 20**

Lightly-shaded entries denote the due date of a written problem set; heavily-shaded entries, that of a machine problem (programming assignment); blue-shaded entries, that of a paper review; and the green-shaded entry, that of the term project.

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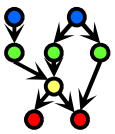
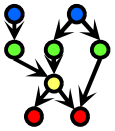


Math Review for CIS 536 / 636

- Overview: First Month (Weeks 2-5 of Course)
  - Review of mathematical foundations of CG: analytic geometry, linear algebra
  - Line and polygon rendering
  - Matrix transformations
  - Graphical interfaces
- Line and Polygon Rendering (Week 3)
  - Basic line drawing and 2-D clipping
  - Bresenham's algorithm
  - Follow-up: 3-D clipping, z-buffering (painter's algorithm)
- Matrix Transformations (Week 4)
  - Application of linear transformations to rendering
  - Basic operations: translation, rotation, scaling, shearing
  - Follow-up: review of standard graphics libraries (starting with *OpenGL*)
- Weeks 5 – 6: More *OpenGL* and *Direct3D*
- Graphical Interfaces
  - Brief overview
  - Survey of windowing environments (SDL in OpenGL, DirectX)



References and Outside Reading

References (to be placed on reserve in K-State CIS Library)

- OpenGL Architecture Review Board, Shreiner, D. & The Khronos OpenGL ARB Working Group (2009). *OpenGL® Programming Guide: The Official Guide to Learning OpenGL®, Versions 3.0 and 3.1, 7th edition.* Reading, MA: Addison-Wesley. ISBN: 0321552628
- Angel, E. (2008). *Interactive Computer Graphics: A Top-Down Approach with OpenGL, 5th edition.* Reading, MA: Addison-Wesley. ISBN: 0321535863 (with *OpenGL: A Primer, 3rd edition*, 2007, ISBN: 0321398114)
- Hearn, D. O. & Baker, M. P. (2003). *Computer Graphics with OpenGL, 3rd edition.* Englewood Cliffs, NJ: Prentice-Hall. ISBN: 0130153907.
- Foley, J. D., VanDam, A., Feiner, S. K., & Hughes, J. F. (1991). *Computer Graphics: Principles and Practice, 2nd Edition in C .* Reading, MA: Addison-Wesley. ISBN: 0201848406
- Orange Book 3e (ISBN: 0321637631), SuperBible *aka* Blue Book 5e (ISBN: 0321712617), formerly Cyan Book

Additional bibliography (excerpted in course notes and handouts)

- Tufte, E. R. (2006). *Beautiful Evidence.* Cheshire, CT: Graphics Press.
- Tufte, E. R. (1997). *Visual Explanations: Images and Quantities, Evidence and Narrative.* Cheshire, CT: Graphics Press.
- Card, S. K., MacKinlay, J. D., & Schneiderman, B. (1999). *Readings in Information Visualization: Using Vision to Think.* San Francisco, CA: Morgan Kaufmann.
- Barnsley, M. F. (1993). *Fractals Everywhere, 2nd Edition.* Burlington, MA: Academic Press.
- Books on Maya and Ogre 3D – to be announced

- ***OpenGL* Tutorials (GameDev *aka* Nehe): http://nehe.gamedev.net**
- **Andy vanDam's Lectures @ Brown: http://bit.ly/cWUxBz**