Introduction to Computer Graphics

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Objectives

• Broad introduction to Computer Graphics
  - Software
  - Hardware
  - Applications
• Top-down approach
• OpenGL
Text Book


• The lectures cover the material in Chapters 1-8
• Survey additional topics as time permits
Prerequisites

• Good programming skills in C (or C++)
• Basic Data Structures
  - Linked lists
  - Arrays
• Geometry
• Simple Linear Algebra
Requirements

- 3 Assigned Projects
  - Simple
  - Interactive
  - 3D

- Term Project
  - You pick
Resources

• Can run OpenGL on any system
  - Windows
  - Linux
  - Mac

• CS lab
  - Linux/mesa
  - Some Nvidia cards
References

• Other helpful references
  - OpenGL: A Primer (Second Edition), Ed Angel, Addison-Wesley, 2004
    • Designed for students who need more programming information
  - The OpenGL Programmer’s Guide (the Redbook) and the OpenGL Reference Manual (The Blue book), Addison-Wesley,
    – The definitive references
    – New edition of red book just released
Web Resources

- www.opengl.org
- www.cs.unm.edu/~angel
Outline: Part 1

• Part 1: Introduction
• Text: Chapter 1
• Lectures 1-3
  - What is Computer Graphics?
  - Applications Areas
  - History
  - Image formation
  - Basic Architecture
Outline: Part 2

• Part 2: Basic OpenGL
• Text: Chapters 2-3
• Lectures 4-9
  - Architecture
  - GLUT
  - Simple programs in two and three dimensions
  - Interaction
Outline: Part 3

- Part 3: Three-Dimensional Graphics
- Text: Chapters 4-6
- Lectures 10-20
  - Geometry
  - Transformations
  - Homogeneous Coordinates
  - Viewing
  - Shading
Outline: Part 4

• Part 5: Implementation
• Text: Chapter 7
• Lectures: 21-23
  - Approaches (object vs image space)
  - Implementing the pipeline
  - Clipping
  - Line drawing
  - Polygon Fill
  - Display issues (color)
Outline: Part 5

- Part 4: Discrete Methods
- Text: Chapter 8
- Lectures 24-27
  - Buffers
  - Bitmaps and Pixel Maps
  - Texture Mapping
  - Compositing and Transparency
Outline: Part 6

• Part 6: Programmable Pipelines
• Text: Chapter 9
• Lectures 28-30
  - Shading Languages
  - GLSL
  - Vertex Shaders
  - Fragment Shaders
Outline: Part 7

- Part 7: Hierarchy
- Text: Chapter 10
- Lectures: 31-33
- Tree Structured Models
  - Traversal Methods
  - Scene Graphs
Outline: Part 8

• Part 8: Curves and Surfaces
• Text: Chapter 11
• Lectures: 34-38
Extra Lectures

• Marching Squares
• Virtual Trackball
• Display Issues
• Fractals
• Sampling and Aliasing
• Bump Mapping
• Environment Mapping
• Reflection and Transmission