CS465: Computer Graphics I
Professor: Steve Marschner

Introduction

Computer graphics: The study of creating, manipulating, and using visual images in the computer.

Problems in graphics

- 2D imaging
  - compositing and layering
  - digital filtering
  - color transformations
- 2D drawing
  - illustration, drafting
  - text, GUls
Problems in graphics cont’d

• 3D modeling
  – representing 3D shapes
  – polygons, curved surfaces, ...
  – procedural modeling

Problems in graphics cont’d

• 3D rendering
  – 2D views of 3D geometry
  – projection and perspective
  – removing hidden surfaces
  – lighting simulation
Problems in graphics cont’d

- User Interaction
  - 2D graphical user interfaces
  - 3D modeling interfaces
  - virtual reality

Problems in graphics cont’d

- Animation
  - keyframe animation
  - physical simulation

Problems in graphics cont’d

- Animation
  - keyframe animation
  - physical simulation

Computer graphics:
Mathematics made visible.
Graphics Applications

- Entertainment
  - film production
  - film effects
  - games
- Science and engineering
  - computer-aided design
  - scientific visualization
- Training & Simulation
- Graphic Arts
- Fine Art

Pixar—Ratatouille (2007)

WETA Digital—King Kong (Universal Pictures, 2005)

id Software—Quake 4 (screenshot: Planet Quake)
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**Graphics Applications**

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**In this course**

- You will:
  - explore fundamental ideas
  - learn math essential to graphics
  - implement key algorithms
  - write cool programs
- You will not:
  - learn a lot about OpenGL or DirectX
    (though you will use some OpenGL)
  - write big programs

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**Course Overview**

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**Topics**

- Rendering 3D scenes
  (ray tracing as the basic model)
- Images and image processing
  (featuring sampling and reconstruction)
- Geometric transformations
- The graphics pipeline
  (with a slant toward understanding graphics hardware)
- Modeling in 2D and 3D
- Color science
**Images**
- What is an image?
- Compositing
- Resampling

**Rendering**
- ray tracing
- shading & shadows
- transparency
- texture mapping

**Geometric transformations**
- affine transforms
- perspective transforms
- viewing

**Graphics pipeline**
- rasterization
- interpolation
- z-buffer
- vertex and fragment ops
Modeling

- splines
- parametric surfaces
- triangle meshes

Prerequisites

- Programming
  - ability to read, write, and debug small Java programs (10s of classes)
  - understanding of very basic data structures
  - no serious software design required

- Mathematics
  - vector geometry (dot/cross products, etc.)
  - linear algebra (just basic matrices in 2-4D)
  - basic calculus (simple derivatives)
  - graphics is a good place to pick up some, but not all, of this

Course mechanics

see web site: