CS-184: Computer Graphics

Lecture #1: Introduction, Overview, and Image Basics

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Today

- Introduction and Course Overview
- Assignments #1 and #2
- Digital Images
The Subject: Computer Graphics

- **Computer Graphics:**
  Using computers to generate and display images

- **Issues that arise:**
  - Modeling
  - Rendering
  - Animation
  - Perception
  - Lots of details...

**Computer Graphics**

- **Applications (in other words, why we care)**
  - Movies
  - Video Games
  - Simulation
  - Analysis
  - Design
  - Others...
Computer Graphics

Applications (in other words, why we care)
- Movies
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- Others...

From Star Wars Episode I, LucasFilm Ltd.

Computer Graphics

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From Finding Nemo, Pixar Animation Studios
Computer Graphics

Applications (in other words, why we care)

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- Others...

From Halo 2, by Bungie Entertainment

From Star Wars: The Force Unleashed by Lucas Arts
Computer Graphics

Applications (in other words, why we care)
- Movies
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- Others...

From America's Army

Image from CAE Inc.
Computer Graphics

- Applications (in other words, why we care)
  - Movies
  - Video Games
  - Simulation
  - Analysis
  - Design
  - Others...

Fluid simulation w/ NASA FAST
Course Topics

- Image representation and manipulation
- 2D and 3D drawing algorithms
- Object representations
- Rendering
- Animation
- Interaction techniques

People

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Send class related email to
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Contact Information

- Class web site:
  - http://inst.eecs.berkeley.edu/~cs184
  - Handouts assignments, etc. will be posted there
  - Lecture notes posted there (hopefully) before classes
- News group:
  - ucb.class.cs184
    - Server: news.csua.berkeley.edu
    - Username/password: usenet/gobears
  - Not reading newsgroup... bad idea
- Email addresses on previous page...

Computing Resources

- Class accounts handed shortly
- Can also use CS Labs
  - Linux
  - Windows
  - Mac
Text Book

- *Fundamentals of Computer Graphics*
  by Peter Shirley
  *Get the current version!*
- Also handouts and other supplemental material will be provided
- See other books listed in course information handout

Grading

- Assignments: 40%
  - Mix of written and programing
  - Average 1 or 2 weeks to do them
- Final Project: 20%
  - Presentation: TBA prior to midterm
- Midterm: 20%
  - Wednesday, October 14, In class
- Final: 20%
  - Thursday, December 17 5:00-8:00pm

- Check now for conflicts!
Prerequisites

- You must know how to program C or C++
  - Big final project, several programming assignments
  - No hand holding
- Data structures (CS61B)
- Math: linear algebra, calc, trig

Waitlist

- Relax for now... there is lots of space.
Class Participation

- Reasons to participate
  - More fun for me and you
  - You learn more
  - I won’t give stupid little annoying quizzes in class

- How to participate
  - Ask questions
  - Make comments

- Stupid questions/comments
  - That’s okay

Assignments #1 and #2

- Assignment #1
  - Setup CS184 account and let us know who you are
  - Get very simple OpenGL program working

- Assignment #2
  - Tests math prerequisites
Academic Honesty

- If you use an external resource cite it clearly!
- Don’t do things that would be considered dishonest... if in doubt ask.
- Cheating earns you:
  - An ‘F’ in the class and
  - Getting reported to the University
  - No exceptions.

Questions?
Images

- Something that represents a *pattern of light* that will be *perceived* by something

- Computer representations
  - Sampled (pixel based)
  - Object based
  - Functional
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Well, this *used* to be in an object based representation...
Images

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- Computer representations
  - Sampled (pixel based)
  - Object based
    - Functional

Function → Polygons → Pixels

Think about making edits...
Storing Images

- Object and Function representations basically arbitrary ...later...

- Raster Images
  - 2D array of memory
  - Pixels store different things
    - Intensity
    - RGB color
    - Depth
    - Others...
  - May be mapped to special HW

- Storing Images

  - Object and Function representations basically arbitrary ...later...

  - Raster Images
    - 2D array of memory
    - Pixels store different things
      - Intensity (scalar value, e.g. float, int)
      - RGB color (vector value)
      - Depth
      - Others...
    - May be mapped to special HW
Discretization

- Real world and “object” representations are continuous.
- Raster images have discrete pixel locations and discrete pixel values

We will see problems from this soon...

High Dynamic Range Images
High Dynamic Range Images

- Dynamic range of the human eye >> range of standard monitors
- Eye adjusts as we look around

Perception

- The eye does not see intensity values...
This striking visual illusion suggests that what we see depends more on what we expect than on any “identity”. Despite appearances, the shaded “light” square (b), and the four “dark” squares (a, c, d, e) are all the same shade of grey. Test this yourself. Look at one for a few seconds, then look at another, and compare it to the various squares on the board.

Perception

○ The eye does not see intensity values...
Storing Images

- Digital file formats
  - TIFF, JPEG, PNG, GIF, BMP, PPM, etc. ...
  - Compression (lossless and lossy)
  - Interlaced (e.g. NTSC television)
  - Tend to be complex... use libraries
- Mapping to memory