CPSC 314
Computer Graphics
Dinesh K. Pai
Lecture 1: Introduction
Course website:
http://sensorimotor.cs.ubc.ca/cpsc-314/
(link also available through Connect)

People

- Instructor: Dinesh K. Pai, pai@cs.ubc.ca
  Office X853. Office hours TBD.
- TAs: Amon Ge, Edoardo Dominici, Prashant Sachdeva, Silver Burla, Syed Iqbal
- For fastest response to general course-related questions, use the discussion board.
  - You can also meet with TAs during scheduled lab times.
  - The instructor is also available by appointment for questions not suitable for the discussion board
About me…

- Professor and Canada Research Chair

Sensorimotor Computation in Graphics

- (2000s-present)

More details at http://sensorimotor.cs.ubc.ca/pai/
Course Communication

- Lectures: MWF 10-11am Dempster 110
- Labs: In ICICS 005. Labs start next week. Attendance is not mandatory but highly recommended.
- Course website: Official announcements, assignments and materials will be posted here http://sensorimotor.cs.ubc.ca/cpsc-314/
- Discussions: We will use Piazza. Please join the course discussion group: https://piazza.com/ubc.ca/winterterm12017/cpsc314/home

Required Textbook

- Available online from UBC library, free to UBC students.
Prerequisites

- One of MATH 200, MATH 217, MATH 226, MATH 253 AND
- One of MATH 152, MATH 221, MATH 223 AND
- Either (a) CPSC 221 or (b) all of CPSC 260, EECE 320
- The following are essential for success
  - good grasp of linear algebra
  - exposure to calculus; “mathematical maturity”
  - “CS maturity”; programming experience
- This is not an easy course!

Grading

<table>
<thead>
<tr>
<th>marks %</th>
<th>work</th>
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<tbody>
<tr>
<td>40</td>
<td>programming assignments (4)</td>
</tr>
<tr>
<td>27</td>
<td>final exam</td>
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<td>33</td>
<td>quizzes (3)</td>
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First assignment will be available next week
First quiz is on September 22, in class.
CPSC 314
Computer Graphics
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What is Computer Graphics?

Many slides courtesy of Min Hyuk Kim, KAIST
What is Computer Graphics?

11

What is Computer Graphics?

12
What is Computer Graphics?

- All of them are purely computer graphics images, created by the latest graphics techniques

Answers: Graphics Graphics Graphics

https://vimeo.com/199867074

THE FOLLOWING PREVIEW HAS BEEN APPROVED FOR APPROPRIATE AUDIENCES BY THE MOTION PICTURE ASSOCIATION OF AMERICA, INC.

www.filmratings.com www.mpaa.org
What is Computer Graphics?

▪ Imaging = representing 2D images
▪ Modeling = representing 3D objects
▪ Rendering = constructing 2D images from 3D models
▪ Animation = simulating changes over time

The Study of Algorithms and Systems for Generating Images with Computers

Includes the study of:
- Representation
- Manipulation
- Interaction
- Applications
Areas of Computer Graphics

- 2D imaging
  - Digital imaging/filtering
  - Color transformations
  - Display technology
  - Compositing and layering
- 2D drawing
  - Sketching, illustration
  - User interface

Areas of Computer Graphics

- 3D modeling
  - Scanning 3D shapes
  - 2D texture mapping
  - Polygons, curved surfaces
  - Procedural modeling
- More in CPSC 424
Areas of Computer Graphics

- 3D rendering
  - 2D views of 3D geometry
  - Projection and perspective
  - Removing hidden surfaces
  - Lighting simulation

- Virtual Reality / Augmented Reality
  - User Interaction
    - 2D graphical user interfaces
    - 3D modeling interfaces
Areas of Computer Graphics

- Animation
  - Physical simulation
  - Key-frame animation
- More in CPSC 426 + grad courses

Allowing artists complete controls over animation

Thin Skin Elastodynamics

Duo Li, Shinjiro Sueda*, Debanga R. Neog, and Dinesh K. Pai

University of British Columbia

*Now at Disney Research Boston / MIT
Human Head Movements

Normal map is used to represent wrinkles and veins

Note: mesh vertices do not move
BD-Tree
Output-Sensitive Collision Detection for Reduced Deformable Models

Doug L. James
Dinesh K. Pai

SIGGRAPH 2004

Output-Sensitive Collision Processing for Reduced-Coordinate Deformable Models
Applications of Computer Graphics

- Movies
- Games
- Computer-Aided Design
- Computer-Aided Analysis
- Simulation Training
- Cultural Heritage
- User Interface
- Information Visualization
- Medical Imaging

Pixar - Ratatouille (2007)
Applications of Computer Graphics

WETA Digital – King Kong (2005)

Applications of Computer Graphics

SEGA – Iron Man 2, 2010
Applications of Computer Graphics

In this course you will learn how to

- Represent 3D shapes
- Transform 3D shapes
- Render 2D images from 3D shapes
- Model shading and lighting
- Create details of appearance using textures
- Program all of the above using the WebGL API and GL Shading Language
For next class

- Review Chapter 1 of textbook
- Review Math 200 and Math 221. We’ll start off by reviewing some essential mathematics for 3D graphics