Outline: 9/12

• Introductions
• What is computer graphics?
• Syllabus
• Images and pixel coloring
• Poll Everywhere and Lab 0
Introductions
To discuss with a partner:

1) Why did you decide to take this class?

2) What are you hoping to gain from this class?

3) Any particular topics you would like to cover?
What is Computer Graphics?
What is computer graphics?

- Creating images using a computer
- Manipulating images
- Modeling and simulation
- Animation and game design
- User-interface design
Creating images
Creating images
Creating images

Brain MRI scan, by Ken Glaser/Corbis, National Geographic
Manipulating images

"DaVinci MonaLisa1b" by David R. Tribble
Manipulating images
Modeling and simulation
Modeling and simulation

Adaptive tissue modeling, Vidal et al, 2006
Animation

“Steamboat Willie”, Disney and Ub Iwerks, 1928
Animation

“Monsters Inc”, Disney/Pixar, 2001
Animation

Elsa: 400,000 strands of hair

“Frozen”, Disney, 2013
Animation

Giraffe: 9 million strands of hair

“Zootopia”, Disney, 2016
Game design
Game design

Angry Birds, Gaming To Learn
Game design
User-interface design

Doctors of the World,
morethanacostume.com
What is computer vision? (not this class!)

- Understanding [natural] images
- Examples: google books, image tagging, self-driving cars
Computer vision

Jeremy Hsu, IEEE Spectrum
Syllabus
Course staff

- **TAs:** Riley Mancuso and Farida Sabry


  - Sunday 7:30 - 9:30 PM  Ford 241  Farida
  - Monday 7:30 - 9:30 PM  Ford 241  Riley
  - Tuesday 7:30 - 9:30 PM  Ford 241  Farida

- **Grader:** Nishit Parekh
Prerequisites

- **CSC 111**: Introduction to Computer Science
- **Math 111**: Calculus 1
Course Goals

- Understand algorithms and math behind graphics
- Build programming skills
- Enable artistic expression
- Resources for pursuing computer graphics further
Assignment Notes

- Mix of programming and pencil-and-paper exercises
- Weekly (usually due Tuesday nights)
- In-class labs not turned in, but count toward participation
- Email me if you do not have a laptop computer
Assignment Notes

- WebGL (i.e. OpenGL in java script/html) and Blender

- Submitted through Moodle

- 4 credit course = 12 hours/week
  
  3 in class, 9 outside class

http://cs.smith.edu/~ssheehan/fall16/csc240/home.html

Username: csc240, Password: fall16
Topics (tentative)

- Graphics pipeline and pixel coloring
- Lines, 2D shapes, and fill algorithms
- Transformations
- Splines and Bezier curves
- Perspective
- 3D modeling
- Lighting, shading, and reflectance
- Texture mapping
- Ray tracing
- 3D printing
- Animation
Textbook

- Free, online, I will post sections on the calendar

- **Introduction to Computer Graphics** by David J. Eck

  [http://math.hws.edu/graphicsbook/](http://math.hws.edu/graphicsbook/)
Online discussion

- Piazza
  - Class discussion
  - Homework help
  - Clarifications
  - Announcements

https://piazza.com/smith/fall2016/csc240/home

Poll for office hours!
Assessment

- Homeworks: 50%
- Midterm exam: 15% (Oct 26, tentative)
- Final project: 10%
- Self-scheduled final exam: 15%
- Participation: 10%
  - In-class labs
  - Poll Everywhere
  - Asking/answering questions in class
  - Piazza
Honor code

- Collaboration encouraged!
- Please cite:
  - student collaborators
  - online resources, especially any code
  - books
- For most assignments: individual original code, **produced and understood** by you
- Occasionally pair-programming assignments
"Smith College expects all students to be honest and committed to the principles of academic and intellectual integrity in their preparation and submission of course work and examinations. All submitted work of any kind must be the original work of the student who must cite all the sources used in its preparation."
Course Policies

1) **Email**: use Piazza for all questions that might be relevant to others in the class
Course Policies

1) **Email**: use Piazza for all questions that might be relevant to others in the class

2) **Sending code**: do NOT email or post long blocks of code on Piazza
Course Policies

1) **Email**: use Piazza for all questions that might be relevant to others in the class

2) **Sending code**: do NOT email or post long blocks of code on Piazza

3) **Late work**: no late work, one assignment dropped
   Exceptions: accommodations letters, notice from Dean or Health Services
Course Policies

4) **Individual meetings**: limited; as I can accommodate in my schedule
Course Policies

4) **Individual meetings**: limited; as I can accommodate in my schedule

5) **Attendance**: two missed classes without affecting your participation grade
Course Policies

4) **Individual meetings**: limited; as I can accommodate in my schedule

5) **Attendance**: two missed classes without affecting your participation grade

6) **Electronic devices**: fine in class as long as directed towards class material
Course Policies

4) **Individual meetings**: limited; as I can accommodate in my schedule

5) **Attendance**: two missed classes without affecting your participation grade

6) **Electronic devices**: fine in class as long as directed towards class material

7) **Random partners**: frequently throughout the semester
Resources

- Piazza
- Office hours (instructor and TAs)
- Fellow students
- Spinelli Center for Quantitative Learning
  - Extra credit toward participation for attending workshops
- Accommodations (turn letters in early!)
What does CSC 240 fulfill?

- Minor in Computer Science: Digital Arts
- Arts & Technology minor
- Distribution requirement for the Computer Science major (Programming, Theory)
What is a digital image?
Raster Graphics vs. Vector Graphics

- **Raster graphics**: pixel by pixel
  - Used in **painting** programs
  - Microsoft paint, Adobe photoshop
Raster Graphics vs. Vector Graphics

- **Raster graphics**: pixel by pixel
  - Used in **painting** programs
  - Microsoft paint, Adobe photoshop

- **Vector graphics**: defined by shapes
  - Used in **drawing** programs
  - Line from A to B, Circle at C with radius r, etc
  - Inkscape, Adobe illustrator
Raster Graphics vs. Vector Graphics

- **Example**: tree in front of a house

- **Question**: if you erase the tree, is the entire house still there?

Images: Draw Doo and drawingmanual.com
Raster Graphics vs. Vector Graphics

- **Example**: tree in front of a house

- **Question**: if you erase the tree, is the entire house still there?

- **Answer**:  
  - vector graphics: yes!  
  - raster graphics: no 😞
Raster Graphics vs. Vector Graphics

- Pros and Cons?
Raster Graphics vs. Vector Graphics

- Pros and Cons?
- Could a photo ever be a vector graphic?
Raster Graphics vs. Vector Graphics

- Pros and Cons?

- Could a photo ever be a vector graphic?

- **Raster graphics**: can’t rescale (image gets “pixilated”), more fine control, portable format
Raster Graphics vs. Vector Graphics

- Pros and Cons?

- Could a photo ever be a vector graphic?

  - **Raster graphics**: can’t rescale (image gets “pixilated”), more fine control, portable format

  - **Vector graphics**: scale arbitrarily, less space to store, easier to interpret
Raster Graphics vs. Vector Graphics

File Formats

- Raster-based

- **GIF** (Graphics Interchange Format)
  - Limited colors, but supports animation.
  - Lossless compression.
Raster Graphics vs. Vector Graphics

File Formats

- Raster-based

- **GIF** (Graphics Interchange Format)
  Limited colors, but supports animation.
  Lossless compression.

- **PNG** (Portable Network Graphics)
  Replacement for GIF, also lossless compression.

Raster Graphics vs. Vector Graphics

File Formats

- **Raster-based**

- **GIF** (Graphics Interchange Format)
  Limited colors, but supports animation.
  Lossless compression.

- **PNG** (Portable Network Graphics)
  Replacement for GIF, also lossless compression.

- **JPEG** (Joint Photographic Experts Group)
  Designed with space/quality tradeoff in mind.
  Best for photos.

Raster Graphics vs. Vector Graphics

File Formats

- Vector-based
- SVG (Scalable Vector Graphics)

Simple image format

PPM: Portable Pixel Map

Based on: slides from Eitan Mendelowitz
Pixel coloring

- Red
- Green
- Blue
- “RGB”, each 0-255

www.colorcodehex.com
### Simple image format

<table>
<thead>
<tr>
<th>Comment</th>
<th>Width Height</th>
<th>Max Color Value</th>
<th>RGB, Pixel 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P3</em></td>
<td>2 3</td>
<td>255</td>
<td>255 0 0</td>
</tr>
<tr>
<td># this is a comment</td>
<td></td>
<td>255 255 255</td>
<td>255 255 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>255 255 255</td>
<td>255 255 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>255 255 255</td>
<td>255 255 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 0 255</td>
<td></td>
</tr>
</tbody>
</table>
Simple image format

$(x, y) = (0, 0)$

```
P3
# this is a comment
2 3
255
255 0 0
255 255 255
255 255 255
255 255 255
0 0 255
```

Based on: slides from Eitan Mendelowitz
Poll Everywhere + Lab 0
What color is represented by the RGB values (0,0,0)?

- **black**: 81%
- **white**: 17%
- **red**: 2%

When poll is active, respond at PollEv.com/saramathieso692

Text SARAMATHIESO692 to 22333 once to join
What RGB value corresponds to pure blue?

When poll is active, respond at PollEv.com/saramathieso692

Text SARAMATHIESO692 to 22333 once to join

(255,255,0) 6%

(0,0,255) 94%

(127,127,255)
What color is represented by (255,255,0)?

When poll is active, respond at PollEv.com/saramathieso692
Text SARAMATHIESO692 to 22333 once to join

- Purple: 8%
- Yellow: 91%
- Cyan: 2%
Say I have a window that is 600x800 pixels. What are the (x,y) coordinates of the center of the window?

When poll is active, respond at PollEv.com/saramathieso692
Text SARAMATHIESO692 to 22333 once to join

(300,400) 94%
(-300,-400) 6%
(0,0)
Please turn in your notecards!