Final Exam Review

CS 148, Summer 2012
Introduction to Computer Graphics and Imaging
Justin Solomon
Last Steps of CS 148

Homework 6

Due ... yesterday
Will not be accepted after Friday
Final Exam
Saturday 8/18/12, 12:15pm-3:15pm

Make-up (if you already signed up)
Thursday 8/16/12, 1pm-4pm
“What Does the Final Cover?”

Everything.
13 questions, skip one.
Reminder

Course Review

Link to Google survey on Piazza.
Computer graphics is a humongous field.
Act I: Real-time graphics

The Big Ideas

Scan conversion
The Big Ideas

Act I: Real-time graphics

\[ d_2 = d_1 + \frac{\Delta y}{\Delta x} \]

\[ \Delta x d_2 = \Delta x d_1 + \Delta y \]

Bresenham's Algorithm
The Big Ideas

Act I: Real-time graphics

Check if each pixel in bounding box is inside the triangle.
Parallelizable

Rasterize border; sweep from left to right.
Less math
The Big Ideas

All points of the form

$$(x, y; w)$$

where we identify

$$(x, y; w) \equiv (cx, cy; cw)$$

for all nonzero $c$.

Act I: Real-time graphics
Act I: Real-time graphics

The Big Ideas

1. Object
2. World
3. Camera
4. Frustum
5. Viewport
The Big Ideas

Act I: Real-time graphics
The Big Ideas

\[ \Delta z \approx \frac{z_{\text{near}} - z_{\text{far}}}{\Delta z_{\text{world}}} \]

Painter's Algorithm

Z-Buffer

Act I: Real-time graphics
Act I: Real-time graphics

The Big Ideas

Clipping

Culling
The Big Ideas

Barycentric coordinates

\[ \alpha_i = \frac{A_i}{A_1 + A_2 + A_3} \]

Act I: Real-time graphics
The Big Ideas

Act I: Real-time graphics
The Big Ideas

```cpp
glTranslatef(0, 1.5, 0);
drawTorso();

glPushMatrix();
  glTranslatef(0, 5, 0);
drawShoulder();

glPushMatrix();
  glRotatef(neck_y, 0, 1, 0);
  glRotatef(neck_x, 1, 0, 0);
drawHead();

glPopMatrix();

glPushMatrix();
  glTranslatef(1.5, 0, 0);
  glRotatef(l_shoulder_x);
drawUpperArm(); ...
```

Act I: Real-time graphics
The Big Ideas

Act I: Real-time graphics

Texture Memory

“Texture Lookup”
The Big Ideas

Act I: Real-time graphics

Diagram:
- Inputs
- Registers
- Shader program
- Texture
- Constants
- Outputs
The Big Ideas

Rods:
Sensitive to light energy

Cones:
Sensitive to color

Act II: Real-world considerations
The Big Ideas

Act II: Real-world considerations
Act II: Real-world considerations
Act II: Real-world considerations
The Big Ideas

Uncanny Valley

Act II: Real-world considerations
The Big Ideas

“Match this color.”

Act II: Real-world considerations
The Big Ideas

**BRDF**

\[ \rho(\vec{k}_i, \vec{k}_o; \vec{N}) \]

Amount of light leaving the surface in each direction given input direction

Act II: Real-world considerations
The Big Ideas

Phong shading

Act II: Real-world considerations
The Big Ideas

Act II: Real-world considerations
The Big Ideas

Act II: Real-world considerations

Global illumination
The Big Ideas

Spatial domain

Frequency domain

Act III: Geometry and sampling
Act III: Geometry and sampling

Spatial domain

Frequency domain
The Big Ideas

Spatial domain

Frequency domain

Act III: Geometry and sampling
Act III: Geometry and sampling

The Big Ideas

Subdivision

$f(0)$

$f(1/2)$

$f(1)$
The Big Ideas

Act III: Geometry and sampling
Curves specify paths that objects take over time.
Act IV: Images and video
The Big Ideas

Act IV: Images and video
Act IV: Images and video
The Big Ideas

Efficiency is a huge issue.

Act IV: Images and video
The Big Ideas

Act IV: Images and video
The Big Ideas

Act IV: Images and video
The Big Ideas

Previous frame

Next frame

Predicted

Act IV: Images and video
The Big Ideas

\[
\begin{align*}
\vec{p}_1 & \mapsto \vec{q}_1 \\
\vec{p}_2 & \mapsto \vec{q}_2 \\
\vec{p}_3 & \mapsto \vec{q}_3 \\
\cdots & \mapsto \cdots \\
\vec{p}_n & \mapsto \vec{q}_n
\end{align*}
\]
Software Systems

Real-time graphics
Software Systems

High-end graphics
Software Systems

Digital photography and video
What Next?

CS 231A:
Introduction to Computer Vision

Fall 2012-2013
What Next?

CS 448B: Data Visualization

Fall 2012-2013
What Next?

CS 248:
Interactive Computer Graphics

Winter 2012-2013
What Next?

CS 232:
Digital Image Processing

Winter 2012-2013
What Next?

CS 247:
Human-Computer Interaction Design Studio

Winter 2012-2013
What Next?

CS 348A:
Computer Graphics: Geometric Modeling

Winter 2012-2013
What Next?

CS 178: Digital Photography

Spring 2012-2013
What Next?

CS 205A: Mathematical Methods for Computer Vision, Robotics, and Graphics

Spring 2012-2013
What Next?

CS 268: Geometric Algorithms

Spring 2012-2013
What Next?

CS 348B: Image Synthesis

Spring 2012-2013
What Next?

CS 348C: Computer Animation

Spring 2012-2013
What Next?

CS 468:
Discrete Differential Geometry

Spring 2012-2013
Again...

Course Review

Link to Google survey on Piazza.

Please!
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