

## 22C:151 Computer Graphics Fall 2007 – Final Exam Review

The final exam will be at 2:15–4:15 pm on Tuesday December 18 in MLH 221

The exam will be open book & open note. You may bring a calculator, but you should really not need it!

The exam will mostly consist of short answer format questions. The basic idea of the exam will be to see if you understand the concepts – determining if you can code is the job of the homeworks, not the exam. At most, you will have to interpret code, not write it. None of the questions are "trick" questions, and most of them have simple answers. The exam is "roughly" the same length as the midterm.

Common themes from the midterm: Make sure you answer ALL parts of a question. When asked for "short answers," one or two words is often sufficient (if you find the need to write more than 2 sentences, you're probably writing too much). Show all your work on computation problems! Also, my suggestion is to read the *entire* exam before starting, so you know which problems will prove difficult and can avoid spending too much time on the simple problems.

Generally, concepts from before the midterm will not directly be covered on the final. (So no line rasterization, for instance. Though the general concept of interpolation maybe be used elsewhere on the exam.)

Things you may wish to review:

- Basic linear algebra
  - Vectors, dot products, cross products, matrix multiplication, etc.
- Texture mapping
  - What is it?
  - How do you map onto a square? A triangle? A cone? A sphere? An arbitrary object?
  - What is a projective texture?
  - When is automatic texture coordinate generation useful?
  - What is texture aliasing? What causes it? How might you fix it?
- What is parameterization?
  - Where is it useful?
  - How is a line parameterized?
  - How about a surface?
- Shadows
  - What types of shadow techniques did we talk about?
  - Review projective shadows (how do they work, how do you compute them, make sure you know they are different than "projective textures")
  - How are shadow maps different than projective shadows? What's the basic idea behind shadow mapping?
  - Could you reproduce high-level pseudo-code doing projective shadows or shadow mapping? Do you understand it?
- Ray tracing & path tracing
  - What's the difference between ray tracing and path tracing?
  - What's the basic idea behind ray tracing?
  - Could you describe (at a high level) how to generate a ray?
  - What do you do with a ray once you have it?
  - How do you intersect rays with a plane? A sphere? A triangle?
  - How are barycentric coordinates useful for ray tracing? What are barycentric coordinates?

- How do you do shadows in ray tracing? How about reflection? Refraction?
- What is the basic idea behind Monte Carlo Integration? Why do we need it for path tracing?
- What is the "rendering equation"? What do the different parts of the equation mean?
- Reflection and Refraction
  - What information do you need to compute a reflection? What's the equation for computing a reflection direction?
  - What information do you need to compute a refraction? What's the equation for computing a refraction direction?
  - What equation relates the incident angle to the transmitted angle (in refraction)?
  - What is total internal reflection? Why would you get total internal reflection?
  - What is a critical angle? What does it mean?
- Vertex and Fragment Shaders
  - Why might you want a programmable shader?
  - How is the underlying hardware different than a CPU?
  - How is programming a shader different than programming in C?
  - What sort of performance gotchas do you have to be aware of?
  - What sort of inputs do you have in vertex and fragment shaders?
  - What can you output from a vertex or fragment shader?
  - What OpenGL state can you access inside a shader?
- Bezier Curves (*only at a high level, depending on coverage on Tuesday, Dec 11th*)
  - Why would one want to use a curve instead of straight lines?
  - What sorts of curves are useful? (e.g., what degree polynomials?)
  - How can you determine a point  $p(u)$  on a Bezier curve?

I will explicitly not answer any of the questions posed above *via e-mail* between now and the final. I will, however, discuss these questions with you in person. You can ask either in class on Thursday December 13th, in my office hours on the 13th, 17th or 18th, or by stopping by my office at other times.

I will have extra office hours on Monday, December 17th from 12:30–2:00 and before the exam on Tuesday, December 18th from 12:30–2:00. I may forget to open my door, so please knock.