CSCI 4972/6963 Advanced Computer Graphics — Quiz 2
Tuesday April 17, 2007 — noon-1:30pm

Name:

RCS username:

This quiz is closed book & closed notes except for one 8.5x11 (double-sided) sheet of notes.

Please state clearly any assumptions that you made in interpreting a question.

Write your answer in the box provided below each question. Be sure to write neatly. If we can't read your solution, we won't be able to give you full credit for your work.

1	/ 7
2	/ 19
3	/ 16
4	/ 8
Total	/ 50

1   Shadow Techniques [/7]

For each shadow algorithm below, check the boxes to indicate the features and limitations inherent in the technique. The features and limitations may be used more than once.

Features / Limitations	Planar Fake Shadows	Projective Texture Shadows	Shadow Maps	Shadow Volumes	Ray Casting Shadows
Allows objects to cast shadows on themselves (self shadowing)					
Permits shadows on arbitrary surfaces (i.e., curved)					
Renders geometry from the viewpoint of the light					
Generates extra geometric primitives					
Limited resolution of intermediate representation can result in jaggie shadow artifacts					

2   Radiosity / Ray Tracing [/19]

2.1   Precomputation [/7]

Radiosity is a multi-step algorithm: 1) divide scene into patches, 2) compute form factors, 3) solve radiosity matrix, 4) render the image. Fortunately, much of the work can be performed as a precomputation and may be reused. For each of the scenarios below indicate which steps must be redone and relatively how expensive the change will be:

	steps to be redone	relative cost
Change the camera position		
Change the light position (which patch emits light)		
Change the total energy emitted by the light source		
Add a light source		
Change the color of one of the walls		
Move an object within the scene		
Add an object		

2.2   Distribution Ray Tracing [/4]

Describe how to extend a traditional ray tracer with motion blur, an effect seen in film images when an object moves fast relative to the shutter speed.

2.3 Forward Illumination [/2]

Circle each of the following algorithms that track light as it leaves the light source and travels throughout the scene:

ray casting   ray tracing   radiosity

Monte Carlo ray tracing   path tracing   bidirectional path tracing

distribution ray tracing   irradiance caching   photon mapping

2.4 Caustics [/2]

Circle each of the following algorithms that will create an optically correct rendering of the caustic formed in a scene with an ant, a magnifying glass, and the sun.

ray casting   ray tracing   radiosity

Monte Carlo ray tracing   path tracing   bidirectional path tracing

distribution ray tracing   irradiance caching   photon mapping

2.5 Participating Media [/4]

Describe a scene in which subsurface or atmospheric scattering is important and summarize a rendering technique that may be used simulate that behavior.

3 Potpourri [/16]

3.1 Sampling [/4]

Describe how to generate points *uniformly at random* on the edge of a circle of radius r centered at the origin in the xy-plane.

3.2 Texture Synthesis [/3]

What parameters control the running time of the texture synthesis method by Efros & Leung? Write the formula for the order notation for the running time in terms of these variables.
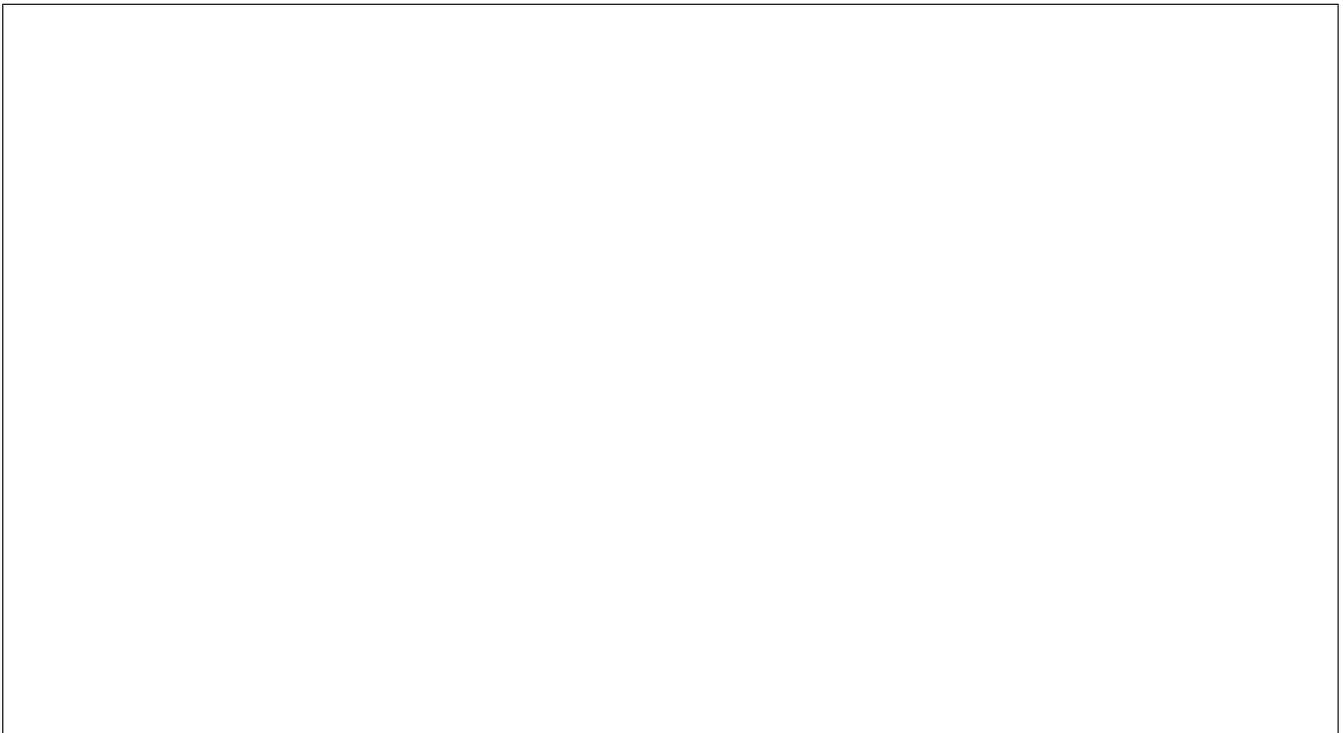
3.3 Temporal Dimension [/6]

When rendering the frames of an animation using a technique such as "Interactive Pen-and-Ink Illustration" by Salisbury et al., what artifact(s) are likely to appear?

How do Meyer & Anderson minimize the appearance of a similar problem in "Statistical Acceleration for Animated Global Illumination"?

3.4 Anyone Got Scissors? [/3]

Draw heavy lines to indicate cut lines on this 3D L-shaped closed box so that it can be unfolded into a single flat shape with no overlaps (*papercraft* style) or prove that it is impossible to do so.
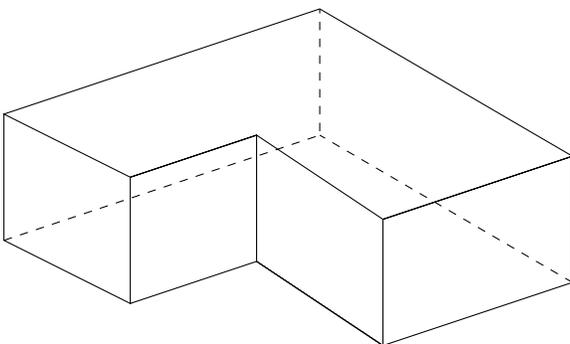
4   Truthiness [/8]

Most of the statements below are false. Identify each statement as false or true, and correct each false statement so that it is true (but still informative).

4.1   Ambient Illumination [/2]

True or False   The ambient term of the Phong BRDF is a hack to approximate color bleeding.

4.2   Procedural Textures [/2]

True or False   Ken Perlin (who is a good rapper) won an Oscar for his noise because it is fast, deterministic, looks random, and can be used to make fake marble.

4.3   Image Analogies [/2]

True or False   "Image Analogies" by Hertzmann et al. can only be used to imitate the style of master artists who painted from photographs because it is necessary to have both A and A'.

4.4   Photo Pop-up [/2]

True or False   "Automatic Photo Pop-up" by Hoiem et al. does not work for natural scenes and can only be applied to man-made geometry such as indoor architectural photographs.