Solutions, CSci 490, Spring 2005, Quiz 3

1. Curved surfaces are most easily represented in most systems with a polygon approximation, but rendering the polygon surfaces shows sharp shading differences if the polygons are relatively large, destroying the illusion of curves. Gouraud shading strives to smooth out the shading by interpolating the color of each pixel based on the colors computed for the various vertices of each polygon.

2. For each row of the image, we select one of five formats: Raw data, offset of pixel color relative to pixel to the left, offset of pixel color relative to pixel above, offset of pixel relative to average of the pixel to the left and pixel above, and offset relative to the complex Paeth prediction formula. After choosing the format, we apply standard text compression to the resulting numbers.

3. The two major ones that I emphasized in class were reflection off of rough surfaces or refraction through transluscent surfaces. Also, Monte Carlo path tracing automatically estimates secondary reflections (i.e., surfaces receive illumination from light bouncing off of other surfaces), whereas standard ray tracing cannot handle this directly.

4. 

The important point here is that a natural cubic spline will go through all of the control points.

5. A straightforward collision detection system would need to check each object against all other objects to see whether it collides with any of them. This is a \(O(n^2)\) approach. With the objects stored within an octtree, we would only need to check for collisions between objects intersecting the same cube of the octtree; as a result, the amount of time taken is likely to be closer to \(O(n)\).

6. • The file dialog study addressed placement of components within the dialog box, showing that placing them along a line in the order they will be used leads to faster usage.
   • The BellSouth study addressed reporting data in a “narrative” format versus a more structured summary format. It found that the more structured summary permitted testers to view problems with the instruments more readily.
   • The nurses’ study involved compressing a report down from three pages to just one. After being trained on both report formats, the study found that nurses could analyze the condensed version more quickly and correctly.

7. Criteria included:
   • Level at: Be at same height as object of interest
   • Facing: Look at an angle relative to object’s normal
   • Size: Maintain distance so that the object of interest falls within a designated size range.
   • Visibility factor: Locate the camera so that the object is largely visible.