Pattern Recognition, Image Processing and Computer Graphics
Test Exam

Rendering Pipeline

The depth test is performed in the fragment processing stage.  ○  ○

Stencil tests are performed in the vertex processing stage.  ○  ○

In Phong shading, the illumination model is evaluated per vertex.  ○  ○
In Gouraud shading, however, the illumination model is evaluated per fragment.

Blending combines the color of an incoming fragment with the framebuffer color at the pixel position of the incoming fragment. The resulting color replaces the respective framebuffer color.  ○  ○

Homogeneous Coordinates and Transforms

The same modelview transform is applied to all objects in a scene.  ○  ○

Affine transformations map the midpoint of a line segment to the midpoint of the transformed line segment.

\((9, 6, 3, 1)^T, (-9, -6, -3, -1)^T, (9 \cdot \sqrt{2}, 6 \cdot \sqrt{2}, 3 \cdot \sqrt{2}, 1 \cdot \frac{2}{\sqrt{2}})^T\) are all homogeneous coordinates of the same point in Cartesian space.

\((3, 4, 0)^T\) is a point at infinity on the line \(4x - 3y + 1 = 0\).  ○  ○

Projections

Perspective projection is an affine transform.  ○  ○

In OpenGL, the orthographic projection is a combination of translation and scaling.  ○  ○
In OpenGL, projective transforms map from object space to clip space.  ○  ○
In OpenGL, perspective projections non-linearly map the z-component from camera / eye space to normalized device coordinates.  ○  ○
**Lighting**

The inverse square law states, that the number of photons emitted in direction $\omega$ and hitting a planar surface area $dA$ orthogonal to $\omega$ at distance $r$ is inversely proportional to $r^2$.

Radiance is radiant flux per unit solid angle per unit projected area incident on, emerging from, passing through a point of a surface in a certain direction.

If wavelengths in the visible spectrum are equally distributed, humans perceive such mixtures as chromatic colors.

In the Phong illumination model, the computation of the specular component is independent from the light source direction.

In Phong shading, the lighting model is evaluated per vertex, not per fragment.

**Shadow Algorithms**

In projection shadows, the geometry of occluders has to be processed twice in the rendering pipeline.

In shadow mapping, the shadow map stores distances to shadowed surface points.

In the z-pass algorithm for shadow volumes, the stencil value at a pixel position is incremented if a fragment of a front face of the shadow volume at this pixel position is closer to the viewer than the closest fragment of the scene at this pixel position.

The z-fail algorithm does not work, if shadow volume polygons are clipped at the near plane.