Sample exam questions

- 1. Given a planar pinhole camera *PPHC(a, b, c, C)* and a 3D point *P*, derive the (*u*, *v*) image plane coordinates of the projection of *P* with *PPHC*.
- 2. Given a circle CC of center O, normal n, and radius r, construct and position a planar pinhole camera that has a horizontal field of view of *hfov* degrees, a horizontal image resolution of w pixels, and projects the circle CC to a circle tangent to the image frame.
- 3. Given two planar pinhole cameras $PPHC_0(a_0, b_0, c_0, C_0)$ and $PPHC_1(a_1, b_1, c_1, C_1)$, derive an intermediate view obtained by linearly interpolating between the two given cameras.
- 4. Given two lines in 3D specified with a pair of 3D points, write a function that decides whether they intersect and, if they do, returns the intersection point.
- 5. Devise an algorithm for rasterizing convex polygons in 2D.
- 6. Devise an algorithm for rasterizing polygons in 2D.
- 7. You shade a triangle by screen-space vertex-color interpolation. Show that the red channel of an interior pixel is as bright as or brighter than the red channel of at least one of the 3 vertices.
- 8. When rasterizing a triangle, when do screen space and model space interpolation of rasterization parameters produce the same results?
- 9. A texture of 256x256 resolution is mapped to a square. A graphics application renders the texture mapped square with nearest neighbor lookup. What problems can occur?
- 10. When modeling a room with a planar mirror on one of its walls, can texture mapping be used to render the mirror? Explain. How could one render the planar mirror correctly?
- 11. Assume you render a complex scene with a planar pinhole camera PPHC(a, b, c, C) with a 150 by 150 degree field of view and a 2,000 x 2,000 image resolution. Describe a rendering algorithm that lets a user explore the scene with a pinhole camera with a 45 x 45 degree field of view and a 256 x 256 image resolution, from the same viewpoint C, without re-rendering the scene, by reusing the large pre-computed image.

- 12. Same as 11 except that the user should now be allowed to translate away from C.
- 13. You render a 3D scene using a planar pinhole camera $PPHC_0$ with a field of view of 50 degrees to obtain an image I_0 , then you pan the camera 20 degrees to $PPHC_1$ and render the scene again to obtain image I_1 . You then replace the scene with two quads that model the image planes of $PPHC_0$ and $PPHC_1$, texture mapped with I_0 and I_1 respectively. Finally you render this new scene with a planar pinhole camera $PPHC_{01}$ which is half way between $PPHC_0$ and $PPHC_1$ ($PPHC_0$ panned 10 degrees). Will you see a vertical seam in the image? Explain.
- 14. A fly walks on a wall with constant speed. A planar pinhole camera observes the scene. The fly appears to walk in the image with greater and greater speed. Explain.
- 15. Describe an approximate method for measuring the field of view of a digital camera.