CS 334
Spring 2007

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.

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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.