

Question 2: (10 points) OpenGL/GLUT

a. (6 points) What is the accumulation buffer in OpenGL? (3pts) How would you use the accumulation buffer in implementing antialiasing? (3pts)

b. (4 points) Why do we set OpenGL/GLUT up for 2D and not 3D when doing ray tracing?

Question 3: (10 points) Cook-Torrance Shading

a. (7 points) Give an expression for the specular term in the Cook-Torrance shading model. (3pts) Explain what each term means (4 pts)

b. (3 points) In the denominator of the Cook-Torrance specular term, why do we divide by the dot product term?

Question 4: (22 points) Ray Tracing

a. (6 points) In raytracing, intersection functions are set up to operate on untransformed generic objects. Why? (3 pts). Explain how you would extend your ray tracer to deal with transforms (3 pts)

b. (8 points) After we determine a hit point in ray tracing, explain how you would use a shadow feeler to determine if that point is in shadow (4 pts). What potential pitfalls could a naïve implementation fall into? (2 pts) How would you fix this? (2pts)

c. (8 points) Explain how Snell's law is used in determining the direction of the transmitted ray in ray tracing. (6 pts) What is the critical angle? (2 pts)

Question 5: (18 points) Raster Graphics

a. (8 points) What restriction of the Digital Differential Analyzer (DDA) algorithm is solved by Bresenham's line drawing algorithm. Give the key expression in the midpoint version of Bresenham's line drawing algorithm that solves this problem and explain its use.

b. (4 points) Describe a technique for rotating a pixel map by 90 degrees without using affine transforms

c. (6 points) Why is the performance of the recursive flood fill raster algorithm poor? (2pts) What property of filled regions would you use to improve performance? (2pts) What data structure would you use in this improvement (2pts)

Question 6: (8 points) Curves

a. (8 points) We have used Bezier curves to model a large spaceship. Then we decide to make a minor change at the tip of the ship. What inherent problems of Bezier curves will we run into? What alternate representations can reduce this problem? Explain briefly.

Question 7 (15 points): Shadows

a. (8 points) Describe the shadow buffer algorithm (4pts) . What is advantage this algorithm has over the “painting shadows as textures” approach described in class? (2pts) Explain (2pts)