Practice Questions

1. What are the shortcomings of environment mapped reflections?
2. What are the shortcomings of billboards when used to render reflections?
3. What are the shortcomings of depth images when used to render reflections?
4. Describe an efficient algorithm for intersecting a depth image with a ray. (For this and all other questions about algorithms also give a high level description of the implementation of the algorithm on the GPU.)
5. Describe an algorithm for approximating ambient occlusion.
6. What are the shortcomings of using a depth image to render geometric detail on surfaces?
7. Describe an algorithm for rendering pixel accurate hard shadows.
8. Describe an algorithm for rendering soft shadows at interactive rates.
9. In depth from stereo one can only reconstruct the geometry of the surfaces seen in both the left and the right image. How can one reconstruct a complete model? What challenges arise and what are the solutions?
10. Design a depth camera for dynamic scenes using a single video camera.
11. How can one render a depth image from a novel viewpoint with correct visibility, but without z-buffering?
12. Radiosity is a global illumination method for diffuse surfaces. Its basis is in the field of thermal heat transfer. In the graphics case, light is transferred from emitters to receivers and potentially reflected. What is color bleeding in this context?
13. In radiosity, which logical objects are the emitters? Receivers? And reflectors? (three answers)
14. Explain intuitively what are the form factor terms Fij in the radiosity equation.
15. Describe the radiosity “gathering” process to solve for the radiosity terms B.
16. Describe the radiosity “light shooting” process to solve for the radiosity terms B.
17. In scene for which a radiosity solution is to be computed, describe, in words, why it might be desirable to decrease the size of the scene triangles near a shadow boundary.
18. Light transport can be written as C=TL. Explain the reasoning behind this equation?
19. Explain what is Helmholtz Reciprocity.
20. If a scene is strictly diffuse with no interreflections of any sort, about which entries in the light transport matrix will be non-zero?
21. If a scene suffers from significant diffuse reflections and interreflection, about which entries in the light transport matrix will be non-zero?
22. If a scene is very specular and has almost no diffuse component, about which entries in the light transport matrix will be non-zero?
23. How would you practically sample the 6D light transport with one fixed projector, a camera moving to several locations, and a static scene?
24. What is the objective of performing an inverse light transport computation?
25. How do you compute the intersection of two 3D rays in space?

26. Using the concepts of camera geometry, correspondence geometry, and scene geometry as described in class, please answer the following:
    a. Given a point x1 on image 1, how can you write the rigid transformation of it to the point x2 on image 2?
    b. Please draw an illustration depicting the epipolar plane constraint on image 2 of camera c2 for a feature x1 on image 1 seen by camera c1.
27. In photometric stereo with known lights, how do you determine the per pixel normal when you have more than 3 observations (e.g., 5)? Please be specific.