

**CS184 Fall 06 Review Sheet (Taken from Old Exams) by Nuttapong Chentanez**  
**True / False**

- \_\_\_\_\_ Raytracing traces the paths of light rays from the light to the eye.
- \_\_\_\_\_ 3D Translation cannot be represented as a 4x4 matrix using homogeneous coordinate.
- \_\_\_\_\_ Each of the three types of color receptors in the eye is sensitive to a single frequency of light.
- \_\_\_\_\_ A shear transformation can be decomposed into a series of rotation and scale transformations.
- \_\_\_\_\_ Homogeneous coordinates are useful because 4D spaces include imaginary vectors.
- \_\_\_\_\_ Linear perspective projection keeps straight lines straight.
- \_\_\_\_\_ Every orthonormal matrix defines a rotation.
- \_\_\_\_\_ Surface shading helps reveal the shape of objects.
- \_\_\_\_\_ Z buffers may suffer from quantization errors.
- \_\_\_\_\_ Rotation about an arbitrary axis requires three separate transformation matrices.
- \_\_\_\_\_ The color of some objects results from wave interference.
- \_\_\_\_\_ The Bresenham line drawing algorithm only became practical once fast floating point hardware was commonly available.
- \_\_\_\_\_ In a perspective projection, a sphere can have an outline shaped like an ellipse
- \_\_\_\_\_ When applying transformations to a 3D scene, the transformation applied to normal vectors should have any translation part doubled.
- \_\_\_\_\_ Raytracing can be accelerated using BSP-Trees or K-D Trees.

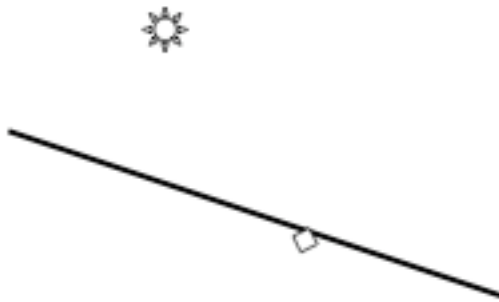
**Short Answers**

1. Imagine that you have an RGB monitor where the red and blue phosphors have been swapped. When one attempts to display the following, what color will actually appear on the display?

Red _____	Green _____
Blue _____	Yellow _____
Cyan _____	Magenta _____
Black _____	White _____

2. In general, how many vanishing points would a perspective view of a pyramid (four sided base) have? Draw a little sketch to justify your answer.

3. Consider the diagram below. A location has been marked on the surface. Indicate a viewer position such that a viewer looking at the surface from that position would see a specular highlight on the surface at the marked location.



4. When clipping two arbitrarily oriented squares against each other to find their intersection (in 2D), what is the maximum number of sides that the resulting shape may have?

5. A perspective camera has its center of projection at the origin  $(0,0,0)$  and its image plane is defined by  $z=1$ . Assuming that we look along  $+z$  axis.

5A. What set of lines vanish at the point  $(2,-1,1)$ ?

5B. Which lines do not vanish at a finite point?

6. Given a rotation matrix, how would you determine its axis of rotation?

7. Given the following: location of center of projection (c)

direction of image plane normal (n)

direction of view up vector (u)

right/left and top/bottom distances (r/l & t/b)

near/far distances (n/f)

Describe how do you set up a viewing transformation that will transform the given setup to the canonical configuration? (You can use the variable names given in parenthesis to refer to the named quantities. Also, the question asks for a

description, not formula. For example if the first step were to rotate the whatever to align with the whateverelse, that is what you should write.)

8. Given the following diagram showing two-dimensional “surface” and the location of the eye, light source, and shading point, annotate the diagram with the light, view, normal, and reflected vectors. Draw the specular lobe assuming a reasonable value for the specular exponent. (If you are concerned about what “reasonable” means, simply indicate the value you have used.)

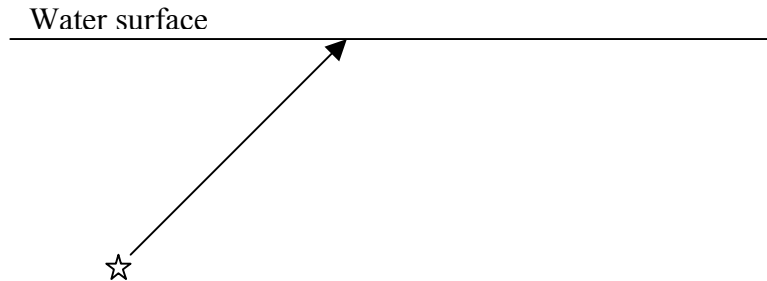


9. Explain why two colors with very different spectral distributions might still look like the same color when viewed with the human eye.

10. In what way is orthographic projection a special case of perspective projection?

11. Given a quaternion that encodes a rotation, how is the rotation changed by negating the quaternion?

12. Diagram below shows a person (the star icon) underwater looking through the water's surface. Show an example of an internally reflected ray and a transmitted one.



13. Write out a 3x3 rotation for a rotation about the Y axis.

14. Of all the rotation representations we have discussed (directional-cosine matrices, Euler angles, Exponential Maps, and Quaternion), which have a unique representation? For those that aren't, explain why?

15. Quaternions can be used to encode rotations in 3D. What is the analogous method for encoding rotations in the plane.

15. Draw a general location of white, red, green, blue and the locus of spectral color in a CIE xy color space diagram.

16. Name an important material that requires sub-surface scattering to be rendered realistically.

17. Imagine that I created an image of two identical looking bumpy objects using bump mapping for one object and texture mapping for the second. Circle those of the following that would cause the texture-mapped object to look less realistic than the bump-mapped object.

Moving the light,    Moving the object,    Moving the viewpoint

If I specified that the object was perfectly Lambertian(diffuse), how would the answer change?

18. The following line segments will be inserted into a BSP Tree in the order indicated. As discussed in class, the polygons themselves will be used to define the split planes. The numbers are on the positive side of each line.

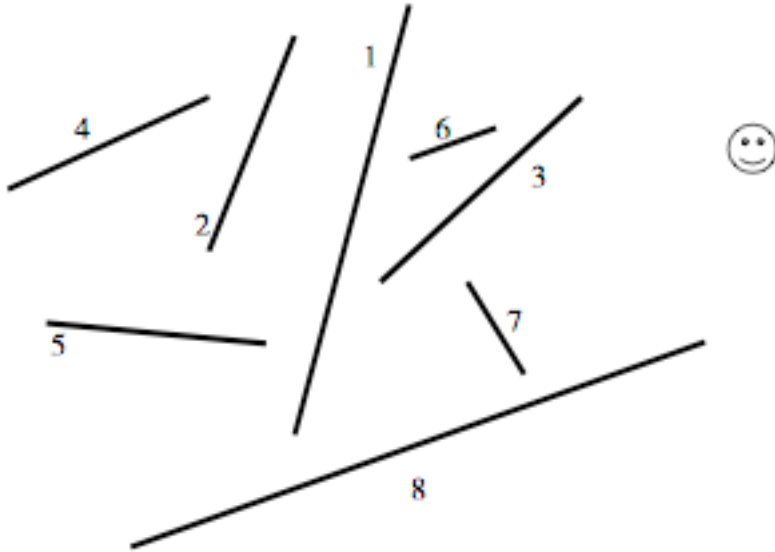


Diagram the resulting tree below. If needed, show where line segments need to be split by marking on the above figure. Also, indicate the names of the split parts by writing labels on the figure above. (For example, if there were a segment 9 and it was to be split, you would draw a mark showing where it would be split and label the resulting pieces 9a and 9b.)

List the front to back traversal order that would result for the location indicated by the viewer icon.