Chapter 5

1. Briefly describe the following concepts and their use in 3D viewing: world coordinate system, view reference point, view-plane, view-plane normal, view-up vector, viewing-coordinate system, view-orientation matrix.

2. Define the term View Volume with respect to computer graphics and with reference to both perspective and orthogonal views.

3. Orthogonal, oblique and axonometric view scenes are all parallel view scenes. Explain the differences between orthogonal, axonometric, and oblique view scenes.

4. A transformation that is not linear is the perspective transformation, still we can describe it using homogeneous coordinates as a matrix multiplication. Draw a sketch and derive the formula for perspective projection, with an observer looking orthogonal at the view plane at the distance *d* from it. Write down the resulting transformation matrix.

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a) In order to specify a 3D view, two coordinate systems are used: the world coordinate system and the viewing-reference system. How is the viewing-reference system specified in the world coordinate system? How, and in which system, is the view window specified?

b) How is the view position specified? In which system? What is the difference between parallel and perspective projection with regard to viewing position?

c) What more is needed to produce a view volume?

6. The perspective transformation is often split into two steps, distortion + orthographics projection. Why?

7. Give a brief definition of *projection* and discuss *orthographic* and *perspective* projections in terms of projectors and the projection plane.

8. Draw a view frustum. Position, and name, the three important rectangular planes at their correct positions. Make sure that the position of the origin, and the orientation of the z-axis is clearly distinguishable. In what coordinate system is the view frustum defined?