EECS 366/466 Homework # 3 Written Part

In this assignment, you may want to use a numerical tool, such as Matlab or your own C programs, to do the calculations. If you do so, please show the details of your work in written form and submit the code you used as well as the results. Please write the results in a legible form.

You are given a scene with two objects and three coordinate frames: two object coordinate frames C_1 and C_2 attached to the objects, and a world coordinate frame W attached to world. The coordinate frames will be visually represented by three line segments starting from each origin, and extending unit length in the three principal directions of the corresponding frames.

The two object models are expressed in their respective model coordinates C_1 and C_2:

O_1: A tetrahedron with vertices at $(0,0,0)$, $(1,0,0)$, $(0,1,0)$, and $(0,0,1)$,

O_2: A cube with vertices at $(\pm 1, \pm 1, \pm 1)$.

Please answer the following questions:

1. Initially, O_1 is located at world coordinates $(0,10,0)$ with its principal axes aligned with the world frame, and O_2 is located at world coordinates $(10,0,20)$ with its principal axes rotated 30^o around the y-axis. What are the corresponding modeling transformations, M_{WC_1} and M_{WC_2}.
2. What are the coordinates of the vertices of O_1, and C_1 in world frame?
3. If the camera is located at world coordinates $(-50,-50,-50)$, looking at origin, with up vector pointing in the $+y$ direction, what is the viewing transformation M_{VW}? What are the corresponding modelview transformations M_{VC_1} and M_{VC_2}?
4. What are the coordinates of the vertices of C_1 and W in viewing frame?
5. If we rotate O_1 around its x-axis for 45^o, what would be the corresponding modeling and modelview transformations M_{WC_1} and M_{VC_1}?
6. If we subsequently rotate O_1 around its z-axis for 60^o followed by its y-axis for -30^o, what would be the corresponding modeling and modelview transformations M_{WC_1} and M_{VC_1}?
7. If we rotate O_2 around the x-axis of the world frame for 30^o, what would be the corresponding modeling and modelview transformations M_{WC_2} and M_{VC_2}?