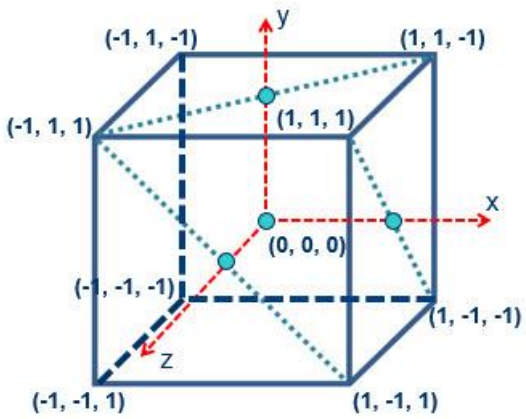
CS 535 Computer Graphics
Homework Assignment 6 (45 points)
Due: 11/15/2024

1. Modify example program 9-2 'Shadow Mapping Method' for the notes "Lighting and Shadows II" to replace the pyramid with the following cube, run the program and turn in a screen shot of the result with 'CS535-P92-YourLastName(+first letter of your first name)' as the title of the GLFW window and a copy of your program. You need to find out where/HOW to make the changes and also make sure the location of the light source would indeed cast shadow of the cube on the torus but would not have the entire torus blocked. A good new location for the light source is (-3.2f, 3.6f, 2.5f). (10 points)



2. What are the parameters of the intersection points of the ray *(0, 0, 30) + t(-3, 0, -4)* with the sphere centered at *(-30, 0, 0)* and with radius 20? You need to know how to do this to implement the ray tracing algorithm. (5 points)

3. What are the barycentric coordinates and parameter of the intersection point of the ray *(40, 0, 10) + t(-1,0,-1)* with the triangle with vertices *(-80,-20,-40)*, *(20,-20,-40)* and *(0, 50,-40)*? You can get the barycentric coordinates and the ray parameter even if the intersection point is outside the triangle. You need to know how to do this to implement the ray tracing algorithm as well. (5 points)

4. What is the reason for using a ***binary tree*** to record the ray tracing process for each pixel of the screen? If none of the objects in the 3D scene is transparent, do we still need a binary tree to record the ray tracing process for each pixel of the screen, why or why not? (10 points)

5. In a ray tracing program we don't perform the clipping process for any objects in the scene at all. **Why?** (5 points: extra credit)

6. The ray tracing technique can be used to compute the volume of an object. Can the ray tracing technique be used to identify the outline of an object with respect to the view point? Justify your answer. (5 points: extra credit)

7. When ray trace an instance of an object transformed by a matrix M, we usually perform the ray tracing process in the local coordinate system of the original object. What is the advantage or advantages for doing the tracing this way? (10 points)

- Solutions must be typed (word processed) and emailed to me both as a pdf file and a word document before 23:59 on 11/15/2024.
- Please name your files as:
  CS535_HW6_2024f_LastName.docx / CS535_HW6_2024f_LastName.pdf