# Assignment 2

CSL7570: Introduction to AR and VR September 24, 2022

1. A viewer is located at position $(2, 3, 5)$ looking at the car locate at origin $(0, 0, 0)$. Find out the axes orientation with respect to the viewer. Assume viewer is on ground.

2. Canonical transform has transformed the frustum to a cubical box fro (0, 1). The viewport transform projects the scene into a screen of resolution $n_x \times n_y$. Find out the transformation matrix.

3. A viewer is located at position $(1, 1, 1)$ with line-of-sight parallel to $z$ axis. If near-plane is located at 1m with horizontal and vertical field-of-view as 60 and 30 respectively. Find out the viewing frustum for user with maximum visible scene depth 10m.

4. A virtual scene is to be illuminated using a virtual sun at $9:00$ AM, $12:00$ PM, $4:00$ PM, and $6:00$ PM. Find out the illumination at center point assuming sun rises at $5:00$ AM and sets in at $7:00$ PM in circular trajectory with respect to center.

5. A point source of 50W is to be moving along top edge of a virtual cubical indoor scene of 10m. Find out the illumination variation at an object located mid-point of lower edge of opposite face to the face containing source.

6. In a HMD setup, distance between display and eyes are 10cm. Find out the distance at which lens-system of focal length 25 mm should be placed so that a sharp image is formed at eye (neglect optics of the eye).

7. Derive the Gaussian Formula for lens i.e. $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$ (Hint: Use geometry relations).

8. Lenses in a HMD setup are suffering from chromatic aberration. Find out the location of the images corresponding to red component of light if refractive indices for red $n_r$ and blue $n_b$ components are 1.39 and 1.44 respectively. Focal length corresponding to blue component for the HMD system is 50 mm, whereas display is located at a distance 50 mm.