Computer Graphics

Assignment 3 - 3D Viewing Pipeline Implementation

Due date: Feb 27th 2025 (Thursday) 11:59 PM

1 Objective

In this assignment, you will implement key stages of the 3D viewing pipeline, including camera transformation, projection transformation, and viewport transformation, to render a 3D cube.

2 Tasks

1. **Camera Transformation:** Implement the $camera\_transform$ function to transform world coordinates into camera coordinates using the given camera position (eye), gaze direction ($gaze$), and up vector (up) in the $main$ function.
2. **Projection Transformation:** Implement the $project\_vertices$ function to apply:
    * **Perspective projection** using parameters such as near and far plane distances, field of view (FOV), and aspect ratio.
    * **Orthographic projection** as an alternative view.
3. **Viewport Transformation:** Implement the $viewport\_transform$ function to map the projected 2D coordinates to screen space, given a specified viewport width and height.

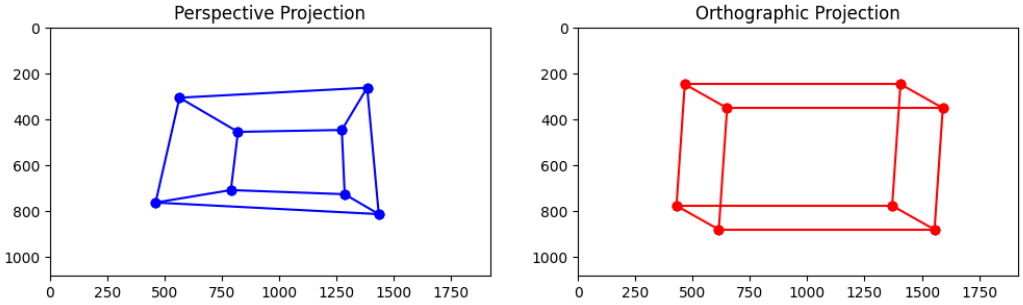

Figure 1: Render Result

3 Expected Outcome

By completing the missing functions, you should generate two plots—one showing the cube under a perspective projection and the other under an orthographic projection, as shown in Figure 1.

Play with the parameters to see how they affect the results.

4 Items to submit

A zip file that contains your Python code (.py or .ipynb) and a PDF report showing the output figures from the main function.