

## CSCI4810/6810

### Program 5 (Assignment 4)

**Due Date:** November 19, 2019, 2018 (Tuesday)

- (a) Consider the object/cube below; it is defined by the following points and lines (in World-Coordinate System):  
(Instead of the cube, you can use any 3D shape made up of lines.)

	<b>X</b>	<b>Y</b>	<b>Z</b>
A:	-1	1	-1
B :	1	1	-1
C :	1	-1	-1
D :	-1	-1	-1
E :	-1	1	1
F :	1	1	1
G :	1	-1	1
H :	-1	-1	1

*The lines are: AB, BC, CD, DA, EF, FG, GH, HE, AE, BF, CG, and DH.*

Write a program to use Perspective Projection to display the cube - given that the viewpoint is at (6, 8, 7.5) with the viewing axis, Ze, pointed directly at the origin of the WCS and Xe-axis lies on the Z=7.5 plane. Assume that the screen is a square of size 30 cm, designed to be viewed from 60 cm away, and that the coordinate system of the screen runs from 0 to 399.

- (b) Implement the function for each of the followings:
- (i) 3D Translate (Basic)
  - (ii) 3D Scale (about any arbitrary point)
  - (iii) 3D Rotations (Basic)
  - (iv) + misc functions that you may need (such as: concatenation, ...)

Embed the above functions into a complete program. **Experiment** with your program (by using different images, changing various parameters, such as changing: the position of the viewpoint, screen size, distance from the screen, number of pixels, applying various transformations, and others). Write-up a report (discuss your experimentation + your findings + interesting results + ...); your report should be between 5 and 10 well written pages (single spaced; font size of 10).

#### **NOTES:**

The routine which does the Perspective Projection must be able to handle any 3D image (not just the cube). There is no need to clip the lines against the viewing pyramid (but note Arabia's instructions as to how to do simple "clipping" – ie, cheating!). DO NOT hard-code the work; your program should do the work.

*(40 points)*