# CI4810/6810
# Fall 2022

*Assignment 3: Program 4 (30 points)*
*Due Date:      October 27, 2022 – Thursday – 11:59pm*

**(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.)*

|        | **X** | **Y** | **Z** |
|--------|-------|-------|-------|
| **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 (12 lines.)

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 30cm, designed to be viewed from 60cm away, and that the coordinate system of the screen runs from 0 to N (N is constant and so you can hard-code it).

**(b)**  Implement the function for each of the followings:

- 3D Translate
- 3D Scale (about any arbitrary point)
- 3D Rotations (about any of the three fixed axes)
- + misc functions that you may need

**(c)**  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 a report. Your mission in writing this report is to convince the reader that your program works correctly and also discuss the impact of each parameter on the results.

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**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 Arabnia's instructions as to how to do simple "clipping"). DO NOT hard-code the work; your program should do the work.


**SUBMISSION:**
Include your report, source programs, and all misc materials together with a demo video in a directory. Upload the directory to ELC for grading purposes (on ELC: go to Tools/Assignment/**Assignment 3** to upload your directory).

The directory should include at least the followings:
1.  Source Code(s)
2.  A Video showing (demonstrating) the execution of your program (illustrating that your program works correctly)
3.  Your report (in PDF) should also be included in the same directory.