

# CS4800/5800 Introduction to Computer Graphics

Sudhanshu Kumar Semwal

<http://www.cs.uccs.edu/~semwal>

EN 180, Department of Computer Science

Phone: 255-3545. E-mail: [ssemwal@eas.uccs.edu](mailto:ssemwal@eas.uccs.edu)

Office Hours: Tuesday/Thursday: 6-7pm; Wed 4:30-5:30pm

Project 2 (Due Date Nov 5<sup>th</sup>, 2019, Demos: October 22<sup>nd</sup>-November 12<sup>th</sup>, 2019)

(20% of the total grade for students in CS4800. CS5800 students to show a demonstration of their term project (demo2) towards 15% of the total grade. Undergraduate CS 4800 students can also choose a term project with their own demo2 and demo3, please contact Semwal for approval of demos2 and 3 if that is the case.)

This project deals with using transformations to place primitives at different locations, and be able to view them. The user should also be able to specify rotations for any limb of the table. There are ten limbs: two table-tops, and four legs with two sub-parts (an upper and lowerleg). All the upper four legs have the same dimensions. Similarly, all the lower legs have the same dimensions. The shape (dimensions) of the table should be read from a file, called the `shape_file`. This allows changes in the shape of the table to be made easily as the program is running. See Figure 1.

To draw the table, we could use a generic cube centered around the origin. This cube will be transformed by using a series of rotations, translations, and scaling to place it at the desired locations for the limbs. Note that for all limbs, the z-axis is along the length (L) of the limbs.

The limits of the joint angles are in a separate file, called the `joint_file`. The limits for Joint Z could look like this: Joint Z: (xmin, xmax, ymin, ymax, zmin, zmax). Values for xmin= -30 and xmax= 45 would indicate that the allowable range of rotation about the x axis for the joint Z is from -30 degrees to 45 degrees. These values can be changed by changing the corresponding values in the `joint_file`.

The local coordinate system for all the joint is shown in Figure 2. All the joints (A-I) can be rotated about the x, y or z axis about their local coordinate system. When a limb is rotating, the other attached limbs also rotate so that the table always remains in one piece. For example, if the table-top rotates then the legs also move accordingly.

You should write the program in such a way that the shape and joint files are read for each iteration, so that the program can pick any changes to these files for the next iteration for display.

The user should be able to **3D-pick** a limb of the table. Once the limb is picked, it goes through the sequence of starting from the minimum to maximum limits of x rotations, then the y-rotations, and lastly the z-rotations in increments of 5 degrees. The effect would be that the limb would rotate about the x, y or z axis in its local coordinate system. Once the joint has completed the rotations as described above, the user can select some other limb for rotation.

Use a similar checkered board pattern as in assignment 1, however, increase the number of squares to at least 20 by 20 (Figure 1) or more.

Use different colors for every limb, and if you like you could have several colors for each of the side of a limb of the table. Provide at least two views showing the scene from different angles, so that all the limbs can be **3D-picked** .

Once the assignment is done, please arrange a time during office hours for a demonstration of the project. I will post the sign up sheet at my office door (EN 180) for project demonstrations.

Good luck. If you have any questions, please let me know.

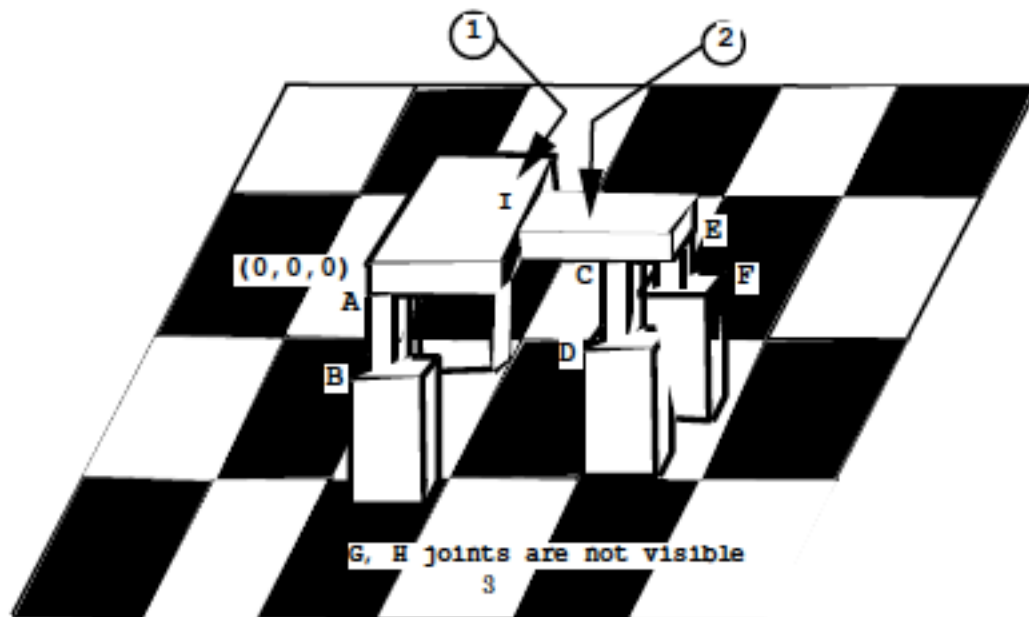
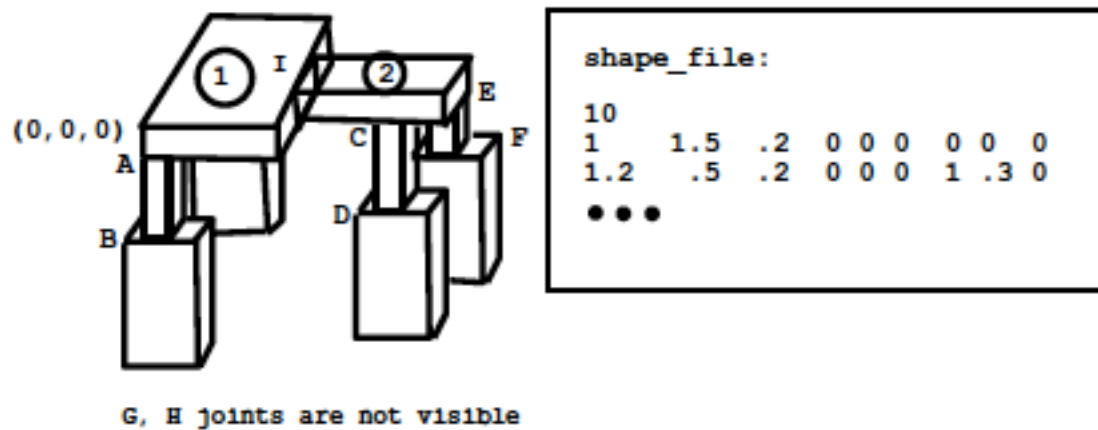


Figure 1: Table with shape file and floor. Joints are also shown.

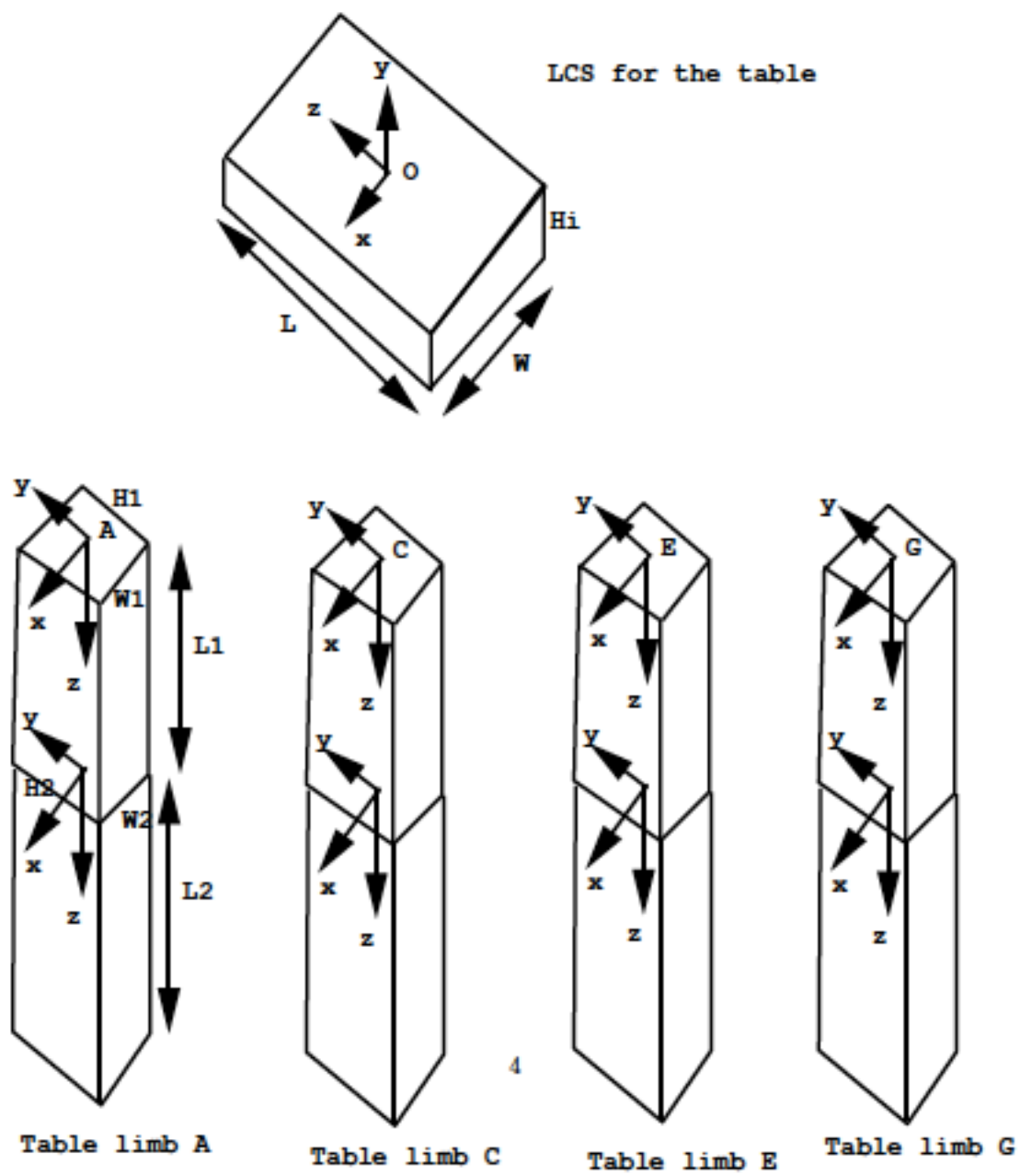


Figure 2: Local coordinate systems for each of the limb are shown