Programming Assignment #2 (22 marks)

Due on: Tuesday, July25, at 23:59:59

Late Policy: Late submissions are possible, but they will be penalized. One day late: 10% penalty; Two days late: 20% penalty; Three days late: 40% penalty; Four days late: 60% penalty; Five days late: 80% penalty; Six or more days late: 100% penalty.

Problem (22 marks): Shading Cow

In this assignment you are going to render a cow model with two light sources. Do not use any other third party libraries other than the cow.js. You may also use the Common folder and code from your programming tutorials if needed.

(a) **[3 marks] Drawing the cow using perspective projection**

There are two functions in the cow.js provided with this assignment. get_vertices returns an array of vertex positions; get_faces returns an array of vertex indices starting from 1. The perspective camera is at (0, 0, 30), and the initial position of the cow is at (0, 0, 0). You can assign an arbitrary uniform color for each vertex for now. Adjust the field of view for the camera in order to see the lights at their initial positions as shown below.
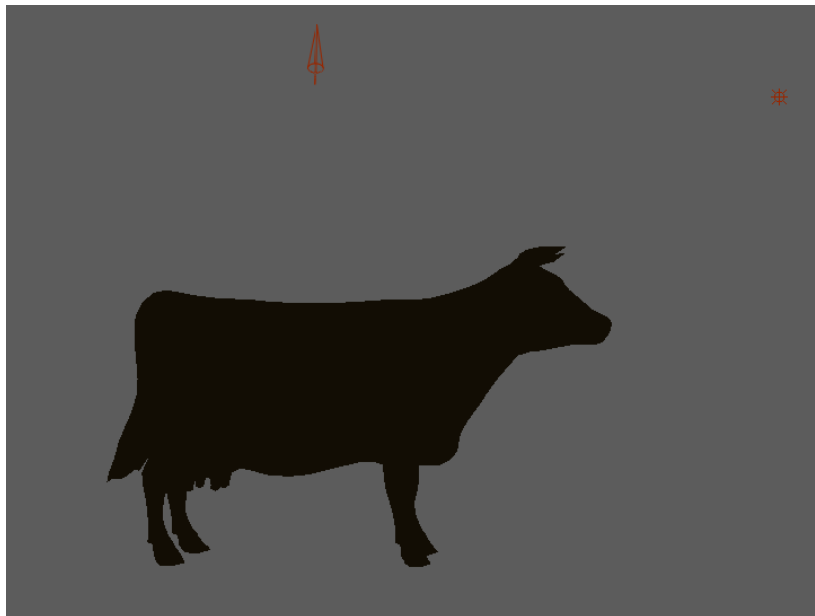
(b) [2 marks] Interactively translating the cow

Implement translation of the cow along the global X, Y and Z axes. The horizontal and vertical movement of the mouse when the left mouse button is pressed should correspond to X and Y translation. The Z translation can be implemented by either the up and down arrows on your keyboard, or the wheel on your mouse if you have one.

(c) [4 marks] Interactively rotating the cow

Implement rotation of the bunny using Euler angles. The horizontal and vertical movement of the mouse when the right mouse button is pressed should correspond to Y and X rotations respectively. Rotation around Z should be mapped to the left and right arrows on your keyboard. Also implement a reset function so that whenever the user press key "r", the cow returns to its initial location and orientation.

(d) [2 marks] Draw an auto rotating point light as a wireframe cube

The point light is at (8,5,5) initially. The point light auto rotates counter-clockwise above the cow in a constant speed. The rotation of the light can be turned on and off by pressing key "p".

(e) [3 marks] Draw an auto panning spotlight as a wireframe cone

The spotlight is located at (0, 6, 6) and aims at the back of the cow initially. The spotlight auto pans side to side (i.e., light position fixed but rotates from left to right and then from right to left continuously). The panning of the light can be turned on and off by pressing key "s". The spotlight has a cutoff angle of 30 degrees and an angular attenuation coefficient $e=1$.

(f) [3 marks] Phong reflection

Implement the Phong reflection model so that the cow looks realistic and 3D. You need to compute vectors such as vertex normals yourself.

(g) [2 marks] Phong shading

Implement Phong Shading so that the cow appears smooth.

(h) [3 marks] Tuning the light and material parameters

Experiment with different material and light parameters so that your cow looks similar to the cow below. Save one screenshot of your whole scene in which your cow looks the closest to the cow below.
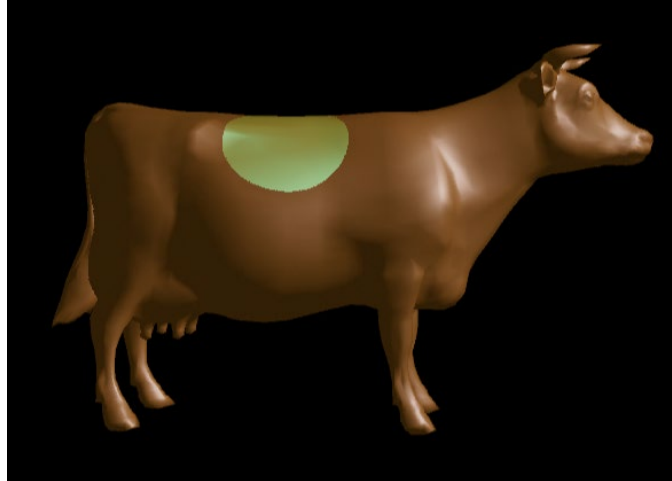
You need not submit individual programs to correspond to these steps. If you can implement all the required parts, a single, complete program is sufficient. **No skeleton code** is provided.

Submission: Please submit a zip file with student number and your name (i.e., `300000001_TerryFox.zip`). The zip file should contain everything we need to run your HTML and JavaScript, and your best rendered image in jpeg format .jpg, and a README file. The README should acknowledge any help you have received and any discussion you have participated, and document any steps not completed, additional features, and any extra instructions needed for the TA to mark your assignment.