24-681 COMPUTER-AIDED DESIGN Spring 2016

Carnegie Mellon University

PROBLEM SET 4

Due: **2/11/2016 (Thu) 3:00PM @ DH A302**
Issued: 2/2/2016 (Tue)
Weight: 3% of total grade

PS4-1 2D transformation of a point and a parabola

(1) Translate a point, (2, 4), in the y-direction by 3, scaled it in the x-direction by 2, and rotate it counter clockwise by 45 degrees. Find the coordinates of the transformed point.

(2) Translate a parabola, $y = x^2$, in the x-direction by 1, rotate it by 30 degrees clockwise, and scale it in the y-direction by 2. Find the equation of the transformed parabola.

PS4-2 Homogeneous geometric/coordinate transformation

(1) Rotate a plane, $x + y + z + 1 = 0$, about the z-axis by 30 degrees counterclockwise and then translate it by 1 in the x-direction. Find the new plane equation in the implicit form.

(2) Three cubes are placed as shown in the figure below. Find the 4x4 homogeneous coordinate transformation from Cube A to Cube B. Also find the transformations from Cube B to Cube A, and Cube C to Cube A.

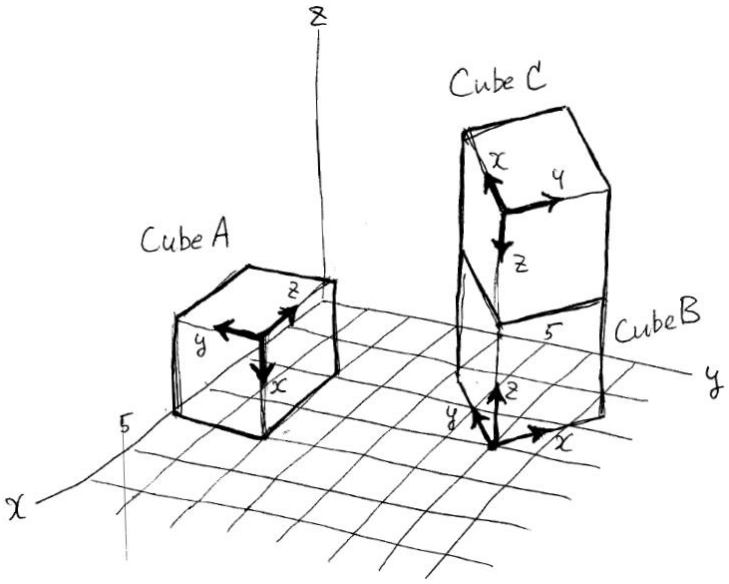


Figure 1

PS4-3 Converting a polygon file to a VRML file

Write a computer program that reads the polygon file, triceratops.dat, and generates a corresponding VRML2 file, "triceratops.wrl." The polygon file and the geometry look like the following.

```
v  3.66093  0.002173  -0.738231
v  3.71948  0.346536  -0.832918
v  3.97733  0.310855  -0.725284
v  4.07667  0.138582  -0.653713
v  4.14038  0.040489  -0.561284
..
.
f  2805  2809  2814  2820
f  2796  2800  2810  2804
f  2788  2792  2801  2795
f  2782  2793  2787
..
.
```

Figure 2 Polygon data file, "triceratops.dat"

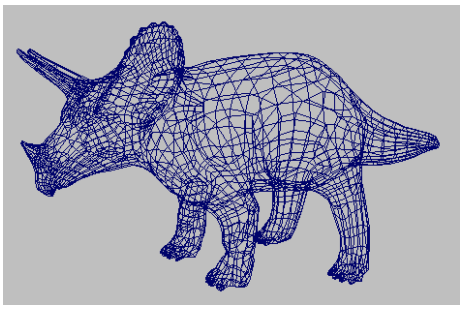


Figure 3 Triceratops geometry

In your VRML2 file, draw the triceratops in red, and include the xyz-axes and your name.

In your hand-in directory on AFS, make a new directory called ps4-3 (in lower case), and hand in:

- VRML file, "triceratops.wrl".
- source codes
- "readme" file that explains on which platform and compiler you ran your code.

Also hand in a printout of the following:

- an image of the VRML file that looks like Figure 4 (Don't hand in a printout of the file content!)

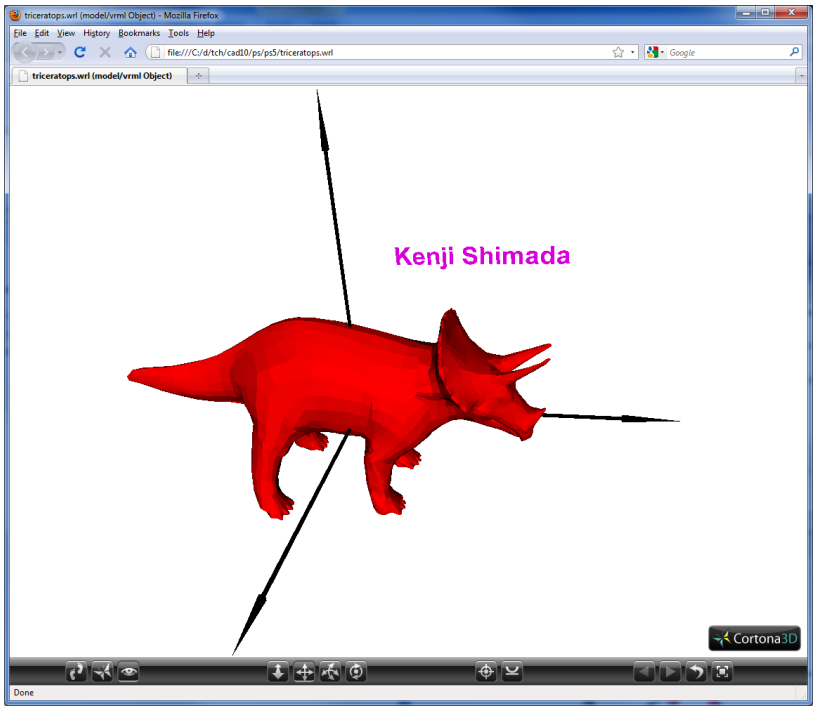


Figure 4

PS4-4 Rotation and scaling of an object

Write a computer program that rotates the triceratops by 45 degrees counterclockwise about the vector (1, 1, 1) and then scale it in x direction by a factor of two. Generate a VRML file "triceratops2.wrl" that shows the original geometry in red and the transformed geometry in green; hand in a printout of the image, and copy the source code and the VRML file, "triceratops2.wrl" to the your hand-in directory on AFS. (Don't use "Transform" command in VRML. The goal of this assignment is for you to learn how to implement transformation operations.).

In your VRML2 file, draw the original triceratops in red and the transformed triceratops in green. Include the xyz-axes and your name.

In your hand-in directory on AFS, make a new directory called ps4-4 (in lower case), and hand in:

- VRML file, "triceratops2.wrl".
- source codes
- "readme" file that explains on which platform and compiler you ran your code.

Also hand in a printout of the following:

- an image of the VRML file that looks like Figure 5 (Don't hand in a printout of the file content!)

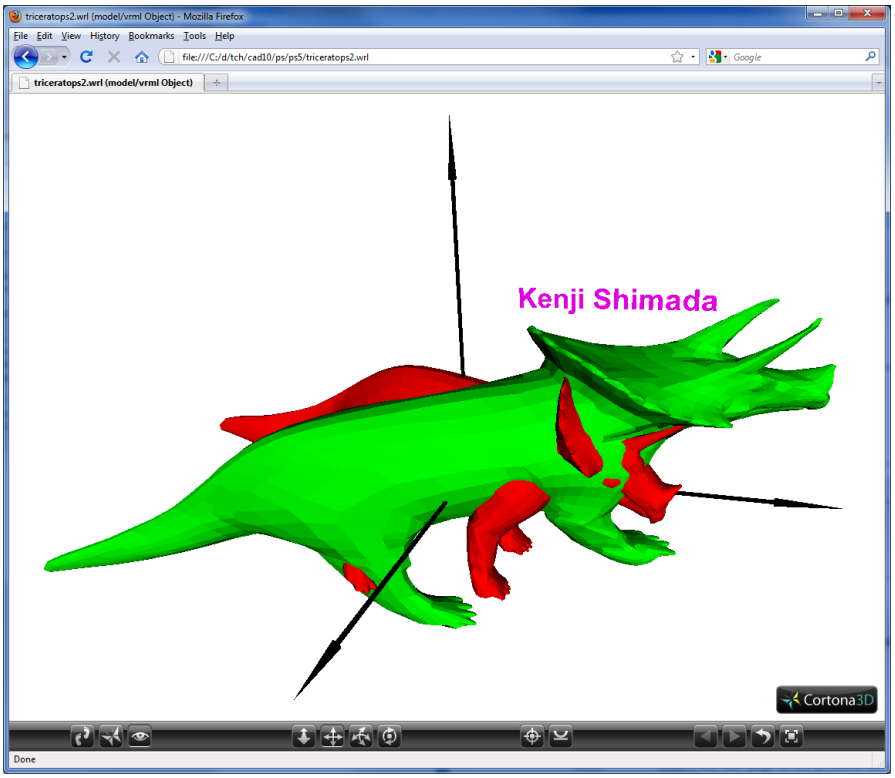
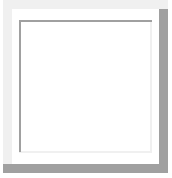


Figure 5

PS4



The first letter of your LAST name _____ First Name _____ Last Name

How many hours did you spend to complete this problem set?

_____ Hour(s)

How many no-penalty late days do you want to use for this problem set?

_____ Day(s)

PS4-1	PS4-2	PS4-3	PS4-4	Following Instructions

24-681 COMPUTER-AIDED DESIGN Spring 2016

Carnegie Mellon University

PROBLEM SET 4

Due: **2/11/2016 (Thu) 3:00PM @ DH A302**
Issued: 2/2/2016 (Tue)
Weight: 3% of total grade