COMP 5812M: Rendering 2021-2022

# EXERCISE 1: Transformations [0 marks]

This exercise is to refresh your knowledge of transformation matrices.

Given the following vertices:

A = (0, 1, 0)

B = (-0.5, 0.2, 0.1)

C = (0.4, 0.4, -0.2)

D = (-2.0, 0.0, -2.0)

E = (-2.0, 0.0, 2.0)

F = (2.0, 0.0, 2.0)

G = (2.0, 0.0, -2.0)

we will manually compute pixel locations on the screen.

Assume the following calls have been made:

a. glViewport(0, 0, 512, 512);

b. glMatrixMode(GL\_PROJECTION);

c. glLoadIdentity();

d. glOrtho(-1.0, 1.0, -1.0, 1.0, -1.0, 1.0);

e. glMatrixMode(GL\_MODELVIEW);

f. glLoadIdentity();

1. Compute the coordinates of A, B, C in:

i. VCS

ii. CCS

iii. NDCS

iv. DCS

and sketch triangle ABC on paper

Example for A:

A is in OCS, so we convert to WCS

WCS A' = MA where M is the model matrix

VCS A'' = VA' = VMA where V is the view matrix

CCS A''' = PA'' = PVMA where P is the projection matrix

NDCS A\* after Perspective Division (i.e. divide by w)

DCS A\*\* = SA\* (after putting a w=1 back on A\*)

row = vert\_scale \* (- y) + vert\_scale

col = horiz\_scale \* x + horiz\_scale

row = 256 \* (- 1) + 256 = 0

col = 256 \* 0 + 256 = 256

2. Compute the midpoint M = (A+B+C)/3 and add:

g. glTranslatef(-M.x, -M.y, -M.z);

then sketch again

3. Compute a rotation matrix for the angle around the axis (1,0,0) and add it as well

h. glRotationf(30, 1.0, 0.0, 0.0);

Sketch again: what happens if you reverse the order of g. and h.?

4. Add the quadrilateral DEFG to your sketch and update the midpoint M to be the average of all vertices. Sketch again.

5. Scale the scene so that all vertices are contained in a sphere of radius 1.0.

Sketch again.

This scene is in an object file that will be distributed for Assignment 1. Working through the example by hand will greatly assist debugging.