CPSC 314
Computer Graphics

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Frames in OpenGL, GLM

Announcements

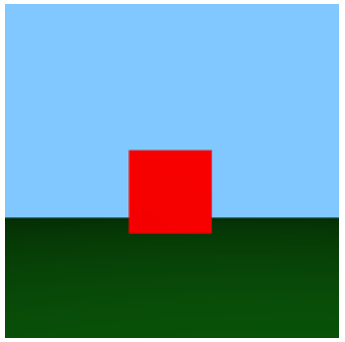
- Assignment 2 now out.
- Start preparation for Midterm 1
- Resources for help
  - Re-read your notes, lecture notes, and textbook now
  - Prof. Pai's regular office hour (ICICS X853):
    W 3-4 (from next week)
  - Extra office hour: Thursday Feb 6, 11-11:50.
    Don't wait till the last minute! May have to go to hospital at short notice!
  - TAs can also help with theory during lab hours! You can drop in on any of the labs.

Assignment 2 demo

C^3: Moving an Object

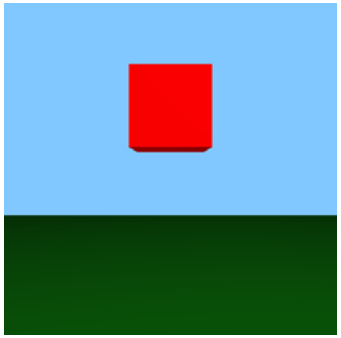
- The output on the screen corresponds to

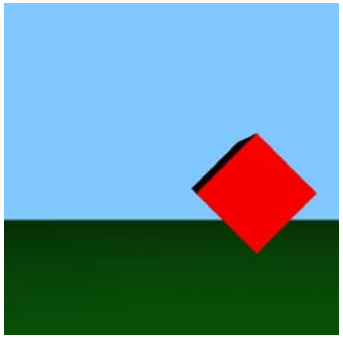
$$O = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \qquad \vec{o}^t = \vec{w}^t O$$

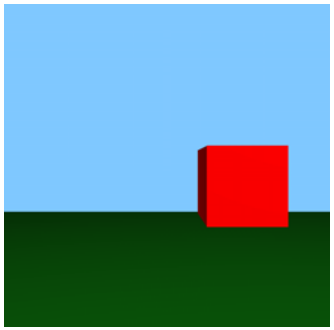


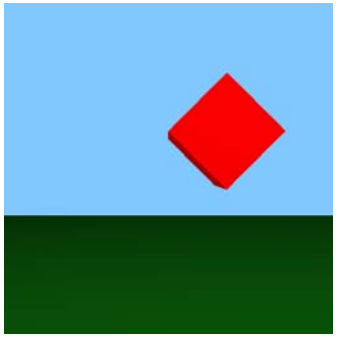
- Which of the following outputs corresponds to

$$O = \begin{bmatrix} \cos\frac{\pi}{4} & -\sin\frac{\pi}{4} & 0 & 0 \\ \sin\frac{\pi}{4} & \cos\frac{\pi}{4} & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

a) 

b) 

c) 

d) 

GLM revisited

- Recall: implements GLSL math functions in C++
- Also includes utilities to create transformation matrices deprecated in new OpenGL
  - glm::rotate
  - glm::lookAt
  - glm::perspective
- #include <glm/gtc/matrix_transform.hpp> to use
- Pass matrix to shader using glm::value_ptr

A closer look at “lookAt”

- Book description in 5.2.3 has a bug, fixed in online Errata (make this and other corrections in your textbook copy)
  - z = normalize(p - q)
    x = normalize(u × z)
    y = (z × x)

C^3 Exercise: Transformation

- Compute the transformation matrix that creates the following motion, all wrt the World frame. Rotate a point around the z axis by 90 degrees, and then scale the coordinates by ½ in all directions, and then translate by (2, 1, 3).

C³ Exercise: Transformation

- Compute the transformation matrix that creates the following motion, all wrt the World frame. Rotate a point around the z axis by 90 degrees, and then scale the coordinates by ½ in all directions, and then translate by (2, 1, 3).

a) $\begin{bmatrix} 0 & -0.5 & 0 & 2 \\ 0.5 & 0 & 0 & 1 \\ 0 & 0 & 0.5 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

b) $\begin{bmatrix} 0 & -0.5 & 0 & 1 \\ 0.5 & 0 & 0 & 0.5 \\ 0 & 0 & 0.5 & 1.5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

c) $\begin{bmatrix} 0 & -0.5 & 0 & -0.5 \\ 0.5 & 0 & 0 & 1 \\ 0 & 0 & 0.5 & 1.5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

d) $\begin{bmatrix} 0.5 & 0 & 0 & 1 \\ 0 & -0.5 & 0 & 0.5 \\ 0 & 0 & 0.5 & 1.5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

e) None of the above