

# ***Computer Graphics***

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# ***Assignment #2***

***Geometrical Transformations***  
***Viewing Transformation***  
***Projection Transforms***



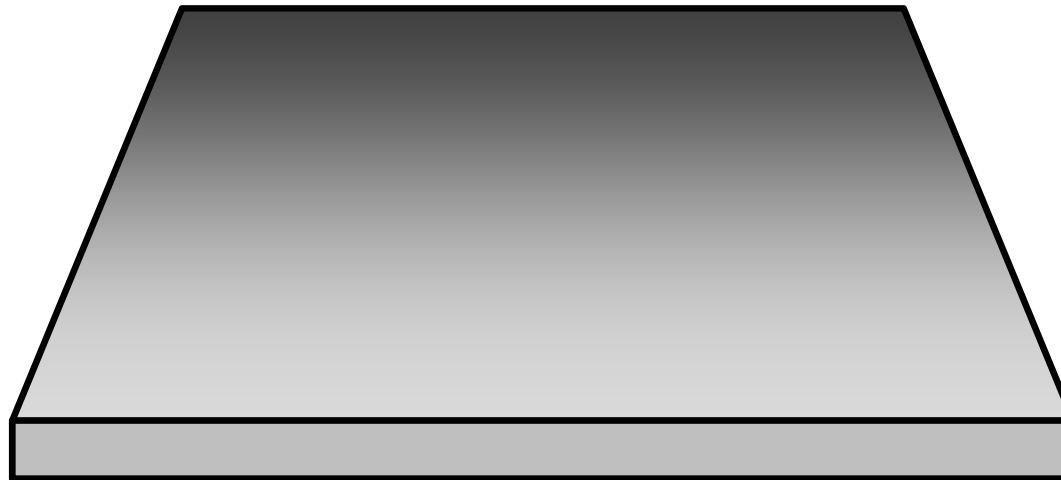
# Requirements

- ◆ You are required to use the framework that TA provided to do some transformations, such as **geometrical**, **viewing**, and **projection**, on the input 3D **models**.
- ◆ Interactive control is required. That is, re-display immediately after the control is done.



# Requirements

- ◆ Design a “**world**” that can load a specific model
- ◆ The “**world**” should contain **a base floor** (a cube with y scale is smaller than x and z scales)
- ◆ Set the vertex colors so that the cube is displayed with the color you assigned as follows



# Requirements

- ◆ Design a “world” that can load a specific model
  - Load a specific model like the assignment #1
  - Place the model properly “**above**” the base floor

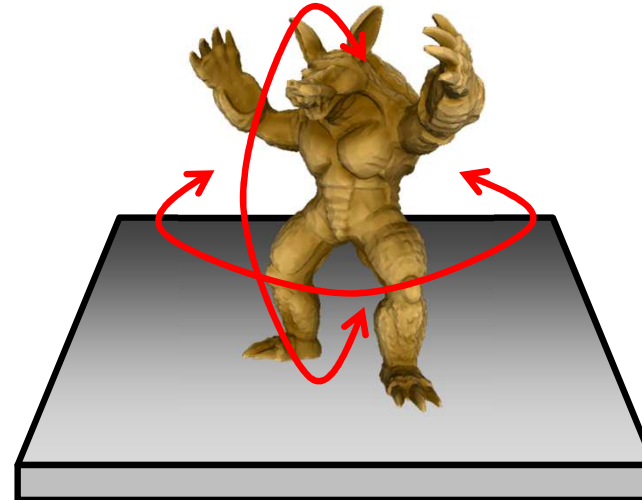
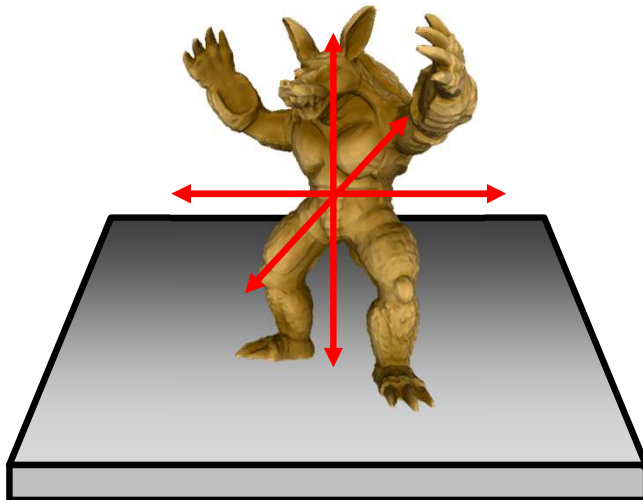


- Switch different model as in assignment #1



# Requirements (cont.)

- ◆ Set the default viewing direction to view from positive Z to origin
- ◆ Set the default projection to parallel projection
- ◆ Use keyboard and mouse to do all the required transformations



# *Requirements (cont.)*

- ◆ Transformation: use the following keys to switch modes and activate operations
  - Mode switch
    - ▶ “g”: geometrical transformations
    - ▶ “v”: viewing transformation
    - ▶ “o”: parallel (orthographic) projection
    - ▶ “p”: perspective projection
  - In geometrical transformation mode
    - ▶ “s”: scaling factors input ( $s_x, s_y, s_z$ )
    - ▶ “t”: Translation offsets input ( $t_x, t_y, t_z$ )
    - ▶ “r”: Rotation angles input ( $\theta_x, \theta_y, \theta_z$ ), in degrees



# Requirements (cont.)

- In viewing transformation mode
  - ▶ “e”: eye coordinates input ( $e_x, e_y, e_z$ )
  - ▶ “c”: center coordinates input ( $c_x, c_y, c_z$ )
  - ▶ “u”: up vector input ( $u_x, u_y, u_z$ ), in degrees
- In parallel or perspective projection modes
  - ▶ input (*left, right, bottom, top, near, far*)
- “i”: Display information such as model name, mode (transformation/projection), active operation (e.g. changing scale factors (1.2, 1.2, 1.2)), etc., in the console window





# *Requirements (Cont.)*

- ◆ **Use mouse buttons to adjust the values**
  - **Eg., in geometrical transformation mode, set transformation to translation (by pressing the key “t” first to activate the operation)**
    - ▶ left mouse button down: drag horizontally for x offset; drag vertically for y offset
    - ▶ Middle wheel for z offset
  - **Eg., in viewing transformation mode, switch to eye coordinates input (by pressing the key “e” to active the operation)**
    - ▶ left mouse button down: drag horizontally for eye x coordinate; drag vertically for eye y coordinate
    - ▶ Middle wheel for eye z coordinate



# *Requirements (Cont.)*

- ◆ **Use mouse buttons to adjust the values**
  - **Eg., in projection transformation mode,**
    - ▶ left mouse button down: drag horizontally for left-right boundary scaling; drag vertically for bottom-top boundary scaling
    - ▶ Right mouse button down: drag horizontally for moving near clipping plane; drag vertically for moving far clipping plane



# *Requirements (cont.)*

- ◆ **Follow the guidelines that TA provided to write the required transformations codes such as geometrical, viewing, and projection, based on the input controls (keyboard, mouse).**
- ◆ **Apply those transformations into the vertex shader codes to achieve the corresponding operations**

# *Requirements*

- ◆ **All the transformations (geometrical, viewing, projection) should be implemented**
  - **Geometrical transformation – translation, scaling, rotation**
  - **Viewing transformation – similar to gluLookAt function**
  - **Projection – parallel and perspective projection, similar to glOrtho and glFrustum (or gluPerspective)**



# ***Input Model Format***

- ◆ **Wavefront 3D Graphics color models as in assignment #1**

# Hints

- ◆ **Use assignment #1 as the basic foundation to revise and add the functions required in assignment #2**
- ◆ **Use the boxC model and modified it for the base floor**
- ◆ **For geometrical transformation, it should apply to the model only**
- ◆ **For viewing transformation, it should apply to both the model and the base floor**



# Hints

- ◆ You have to illustrate your control clearly so that TA can justified the correctness of your implementation
- ◆ You are required to demonstrate the implementation yourself to TA if there is a need
  - Operations incorrect
  - Insufficient documentation for the operations
  - Book the time with TA if you would like to showcase any fancy operations you have done



# ***Due Date***

- ◆ **Two weeks after announcement. (Should be 4/12)**
- ◆ **Submit your assignment, source codes, executable binary on PC, and your documentation, to course webpage at NTHU iLMS system.**
- ◆ **Contact with TA if you don't know how to submit your work.**
- ◆ **Late submission is allowed with less score**
- ◆ **No score if you don't submit you assignment**
- ◆ **If you copy from others, your score will be downgraded or become zero.**





# Q&A

