

ASSIGNMENT 2

HIGHERARCHICAL MODELLING, VIEWING, LIGHTING

G53GRA Computer Graphics

March 11, 2019

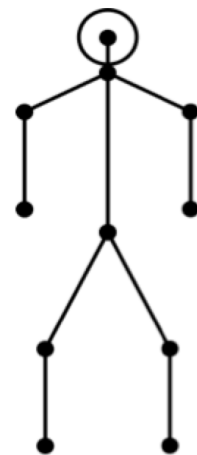
This assignment is compulsory and worth 10% of your final mark for this module. It is due for submission via Moodle by **11am Friday 22th March 2019**. Late submissions will receive a penalty of 5% of the assignment grade per working day.

Two files should be submitted: one *zip file* containing your code, including executable (we must be able to run your program without having to reset the 'include' and 'lib' directory paths), and one *pdf file* containing your explanation of your code (you must explain your code) and your answers to the questions. Please provide screenshots in your pdf file.

This assignment is based on lectures on hierarchical modelling, viewing, and light models.

1 Hierarchical Modelling

Use OpenGL commands and freeglut to create a *hierarchical* model of a robot. The skeletal structure of the robot should generally follow the diagram, where the individual line segments (separated by ●) correspond to the individual components you should model and render using some basic polygonal shapes. Provide screenshots in your pdf file.



2 Viewing Transformation

This question is to about conversion of World coordinates to View coordinates.

Suppose the View space coordinate axes are defined as follows:

$$\mathbf{u} = (0, 1, 0)$$

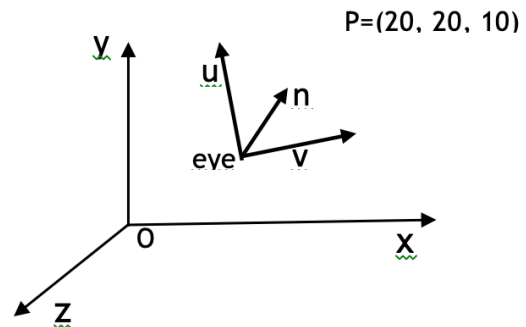
$$\mathbf{v} = (1, 0, 0)$$

$$\mathbf{n} = (0, 0, -1)$$

where \mathbf{u} is the *right* vector, \mathbf{v} the *up* vector, and \mathbf{n} is the *viewing direction*.

Suppose that the eye/camera is positioned at $\mathbf{eye} = (10, 10, 10)$ in World space. The coordinates of a point P in World space is $(20, 20, 10)$. What are P's coordinates in View space?

You must show your working.

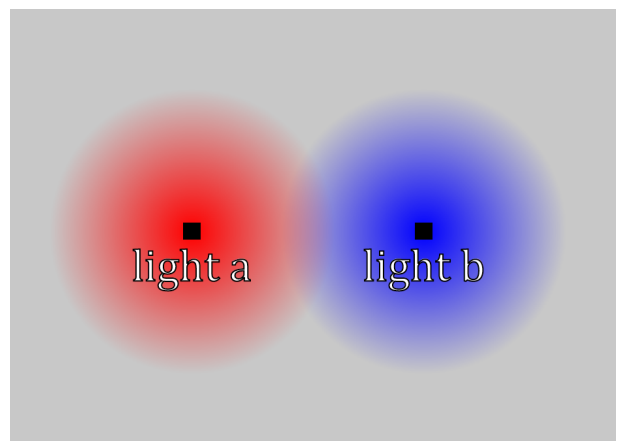


3 Light and Texture

3.1 Wall light

This question is about light reflection and attenuation.

Use OpenGL commands and freglut to model a 'wall' light. The 'wall' should be perpendicular to the view direction (such that you can see the wall straight on), and a positional light of colour in front of, or 'on the wall'. Hint: you may use light attenuation, which is inverse to distance to light squared: $a = \frac{1}{1+kd^2}$, but you only need to provide a number between 0 and 1.



An example wall light is shown. Provide screenshots in your pdf file.

Note: You may find the `Floor` class from the viewing lecture demo helpful.