

# CS 405 Project 3: Scene Graph + Illumination

Yasemin Sarpkaya

29172

## Task1:

First of all transformations are applied in order to correctly position, orient, and scale the object in the 3D space before rendering it on the screen. Different transformations like rotation and scaling (this.trs) are applied to mvp, modelView, normalMatrix and modelMatrix matrices. Then by iterating over the children of objects and each child is drawn on the screen using the provided transformed matrices.

## Task2:

For the meshDrawer in the 2nd task, I made use of the meshDrawe code in the 13th week recitation.

First of all diffuse lighting is calculated via taking the maximum of the dot product between the normalized surface normal and the normalized light direction, and zero. This ensures that negative dot products (indicating light from behind) are clamped to zero for accurate diffuse lighting calculations. In this way negative dot products which indicate the light is coming from behind the surface, are neutralized and only light hitting the surface from the front contributes to accurate diffuse lighting calculations.

The second step was to calculate normalized view direction vector by negating the surface normal and normalizing the result to provide correct reflection of the light to viewers perspective.

Then by using the light direction vector and the surface normal how much light is reflected towards the viewer is calculated. Finally specular lighting contribution to final color is added by making use of dot products and Phong reflection model.

### Task3:

marsNode rotation is set to  $1.5 * zRotation$ .

First of all mesh data (position, texture coordinates, and normal buffers) are set for Mars via MeshDrawer. Then I used the provided URL for the texture of Mars. Then a new TRS is set to handle translation, rotation, and scaling: translate Mars -6 units on x and scale by 0.35. Finally by instantiating a SceneNode, Mars is set as a child Node of Sun.