Faculty of Science

Course:	CSCI 4110U: Advanced Computer Graphics
Lab Assignment:	5
Topic:	Animation - Behavioural

Overview

In this lab, you will animate a flock of space ships, using the Boids model discussed in the lectures. The code to animate a single *boid*, from the in-class example, is provided. You are expected to make modifications to this program to make it render multiple boids, and update the force, acceleration, velocity, and position of each boid in a loop.

Further details of this model can be found at:
- https://www.red3d.com/cwr/boids/

For inspiration, an implementation can also be found at:
- https://processing.org/examples/flocking.html

Instructions

First, you should download the base project from the repository is given, below:

- https://github.com/randyfortier/CSCI4110U_Labs

Every boid will have a range of perception. For simplicity, we will use a simple circle for our area of perception. Therefore, a radius of 1.0 will be used to determine if another boid should influence each boid.

The animation will be driven by three components:
- Cohesion – Boids will try to steer toward the average position of all boids in range
- Separation – Boids will try to steer away from all boids in range
- Alignment – Boids will try to steer toward the average direction of all boids in range

For each boid, go through all other Boids. If the distance between the two boids is less than the radius of influence, then that boid will be included in the list of influential boids for the current boid.

Cohesion
Go through each boid in the list of influential boids, and calculate the average position. For the current boid, determine a vector toward this position.

Separation
Go through each boid in the list of influential boids, and determine which boids are too close. A comfort distance can be used for this purpose. Calculate the average position of all boids within the comfort distance, and generate a vector pointing away from the average position.

Alignment

Go through each boid in the list of influential boids, and calculate the average direction. For the current boid, determine a vector that, when added to the velocity of the current boid, would cause the boid to be pointed toward the average direction.

Once you have calculated all of these vectors, we're going to perform a weighted average of the vectors to determine a final force vector to be applied to our boid. You may need to play around with weights in order for this to work, but some good starting points would include:

> Cohesion: 0.3
> Separation: 0.4
> Alignment: 0.3

Need an Extra Challenge?

If you feel like this is too easy for you (e.g. you have some background with OpenGL), you are welcome to try one of these variations (presented in order of difficulty):

1. Include a randomly-generated target position for all boids to seek
2. Add obstacles to the map (displayed or not) that the boids will try to avoid (similar to separation)

Lab Report

To demonstrate to the lab instructor your completion of this laboratory assignment, merely show them the modified OpenGL program.