

## Flocking Simulation

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**The Task:** Using `a3.cpp` and `support.h` on Stream, you must implement the three rules for the Boids model to make the ships fly in groups.

**Follow these steps:**

1. Download `a3.cpp` and `support.h`
2. Put these two files in the same folder. Do not change `support.h`
3. Open, compile `a3.cpp` and run as normal
4. Write the implementations of `AddAlignmentRule()`, `AddCohesionRule()` and `AddSeparationRule()`

**Notes:**

Tip: Another rule has been added which tends to point ships towards their targets to attack them. This is the `AddAttackRule` function. You should disable this function to just see what your rules are doing.

Note: There are no perfect parameter sets for this simulation. You are free to modify the parameters as you see fit.

**`void AddAlignmentRule(Ship *s);`**

For this rule, you need two floats to help you average the velocity vectors of ships within a distance of `g_alignment_radius` to the Ship `s`. Before adding this average velocity to the velocity of the Ship, you need to multiply it by a small coefficient in order to add a smaller vector. This coefficient is provided for you, `g_alignment_desire`.

**`void AddSeparationRule(Ship *s);`**

For this rule, you also need two floats to help you find a vector that points to the centre of mass of the ships nearby. First, make a loop that finds out which ships are within a range of `g_separation_radius`. Then, for each of these, you need to calculate a relative vector from the Ship `s`. Average all of these relative vectors. Then finally, you multiply this vector by a small coefficient, `g_separation_affinity`.

**`void AddCohesionRule(Ship *s);`**

For this rule, you need two floats to help you average the position of ships that are nearby. Add all the positions (x and y coordinates) of the ships within a distance of `g_cohesion_radius`.

**Marking:**

The assignment is worth 15 marks, and these are awarded as follows:

- 4 marks for each rule implemented correctly
- 3 marks for ensuring that ships fly only with ships of the same colour.

**Submitting**

Please submit your `a3.cpp` source file via Stream. You are welcome to develop your assignment on a home computer, but you **must** ensure that your program works in the labs. **Do not modify or submit support.h.**

If you have any questions about this assignment, please email the lecturer.