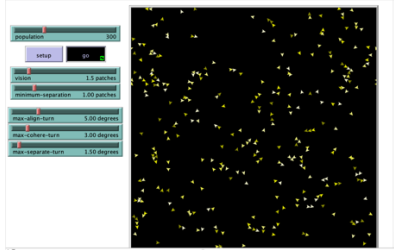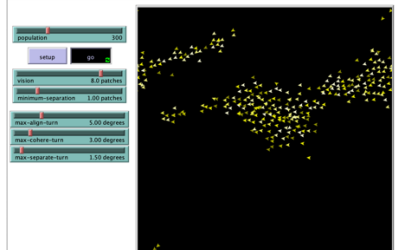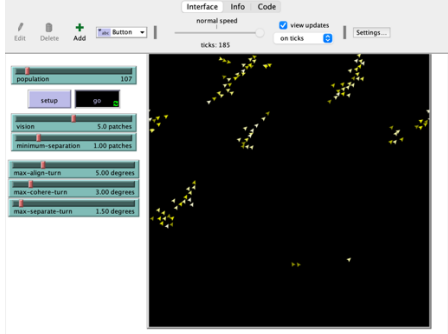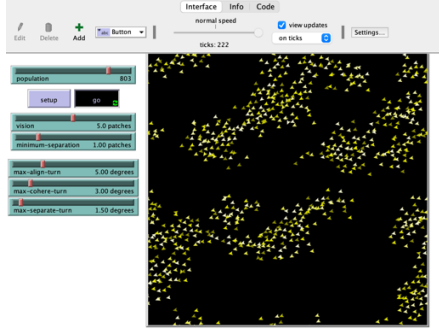# Final Exam

Alizeh Murtaza

The Agent-Based Model Analysis this paper will be discussing is the Bird Flocking Model, also known as "Boids". This NetLogo model was created to simulate the flocking of birds. More specifically, how birds interact with each other while also taking into account outside factors that may or may not affect their flocking. An agent is represented by an individual bird. These agents follow rules called "Alignment," "Separation," and "Cohesion." Alignment refers to each agent (bird) moving towards the average path of those around them. Separation refers to each agent creating a considerable distance with those around them to avoid collisions. Cohesion refers to each agent being drawn to the mass number of agents. The birds adjust their speeds based on those around them as well, making sure not to collide with one another. Their environment in this model is a 2D environment including features such as obstacles and other factors that can account for a real-life scenario to influence the way they move and interact.

When making a 'typical' run of the Bird Flocking Model, one can expect birds that are not cohesive to find each other and start to flock together.

Parameter	Effect on Flocking Behavior
Vision Radius	As the vision radius increases, the number of cohesive flocks also increases
Population	As the population increases, the flocks tend to take longer to form
Separation	As the separation increases, the flocks tend to loosen

Table 1: This table will identify the parameters and impacts on flocking behavior

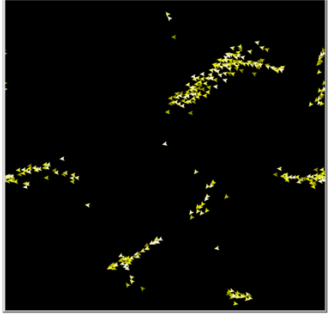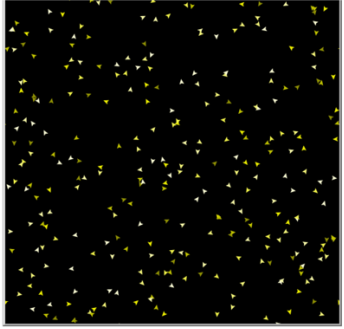| Parameter	Decreased Parameter	Increased Parameter
Vision		
Population		

Minimum-separation		

Table 2: This table shows the difference in decreasing and increasing each parameter specified with screenshots from the Netlogo simulation.
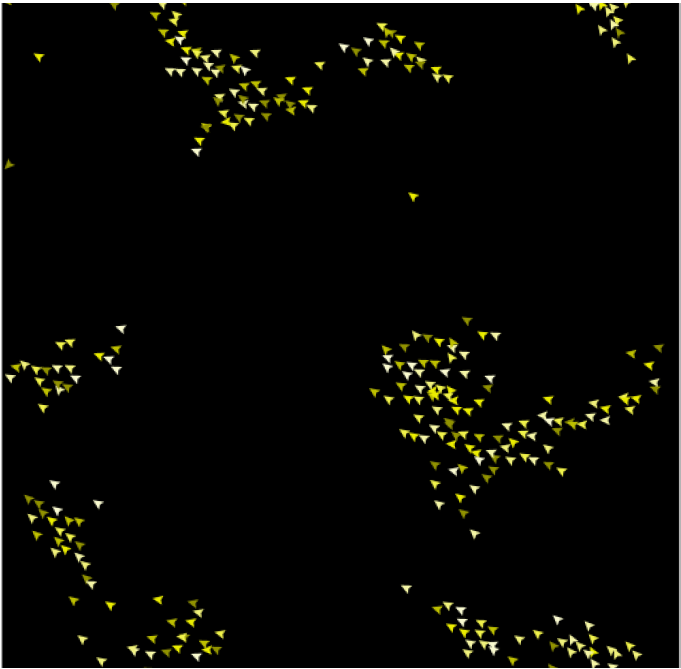

Figure 1: This figure is a screenshot of what can be expected from running the Flocking Model.

This result shows that, although there are some outlier agents (birds), most of the birds find each other flock together in the simulation.

The Bird Flocking Model shows a very valuable understanding of real-life flocking of birds through its various factors and parameters; however, it still is not a completely accurate simulation. The organization of this model is definitely commendable and is effective in demonstrating how the collective mimics the actions of the individual agents. It also effectively shows how on the micro or agent level, each bird has behaviors (i.e. alignment, cohesion, separation), and how the macro level is affected by it through flocking behavior. The model is accurate in the way that it relies heavily on the individual birds' behaviors and has that reflect the group's goals and behaviors.

On the other hand, the Bird Flocking Model has flaws as well. The parameters that it consists of are well-thought out, however they are still too simple to accurately depict real-life scenarios. Factors such as different environments, leaderships, etc. are not accounted for; and therefore, disregarded. Similarly, the bird's ability to adapt is not included either. Outliers that are in the simulation exist to account for birds that have outlying factor about them that prevents them from flocking, however, they may learn and adapt to flock eventually in real life, which would have a significant influence on results of the simulation.

The Boids Model is a proficient model to simulate the flocking of birds and demonstrates emergence patterns from individual birds or agents following rules to the collective group behavior reflecting this. As shown in the tables and images above, the parameters vision radius, population, and separation all play a role in affecting these emergence patterns. This shows the rich element of the model and arguably the most important. Although there are positive and negative factors of the Boids Model, it gives an idea on bird flocking and insight on how

emergence patterns can be understood and affected. The simplicity of the model can be seen as a withholding aspect, but also insightful as well.