Math/CS 471: Homework 5

1. The parameters in the angry birds simulation have different roles in how the birds behave:

-Gamma 1 (tastiness of bird feed), determines how closely the lead bird follows the crazy bird feeder. For example, when the crazy bird feeder travels in a circle and Gamma 1 has a value of 0.5, it causes the lead bird to mimic the bird feeder's movement in a circle with a much smaller radius. A value of 2 causes the bird leader to follow the bird feeder almost exactly.

-Gamma 2 (charisma of the bird leader), determines how closely the flock follows the lead bird, much like Gamma 1. For example, a Gamma 2 value of 1 causes the birds to follow the bird leader closely in the circle path that the bird feeder takes, but with a slightly smaller radius.

-Kappa (Center of gravity), determines how the birds want to be at the center of the flock. For example, a value of 2.5 will cause the birds to follow the leader, but not stay close to one another, while a value of 3.5 will cause the birds to stay in tight group while following the leader.

-Lambda is the number of neighbors that a bird will take into account when trying to stay out of each other's way. A value of 2 will cause the birds to fly very close together, while a value of 4 will cause the birds to spread out very far.

-Ro is one of the numbers used in determining how repellant birds are to each other. For example, a value of 0.5 causes the birds to essentially fly on top of one another, while a value of 2.5 causes them to not fly as a flock at all.

-Delta is the other number used in determining how repellant the birds are to one another. For example, a value of 1.5 causes the birds to fly close enough to become one, while a value of 0.5 causes them to have no concern about flying as a flock.

2. The diameter of the flock can be roughly determined by the distance between two birds that are the furthest from the flock's center of gravity on opposite ends of a relatively straight line that runs through that center of gravity. The diameter can fluctuate depending on the movement of the leader and the values of the parameters Lambda, Ro, Kappa, and Delta. A slow moving leader with certain parameters will cause the flock to converge on one another quickly, while a very mobile leader with the same parameters will cause the flock to maintain a certain distance from one another.

3. In a shared leadership position, the flock will do their best to follow both leaders. In the case where the leaders are seeking the same goal, this doesn't change much, but if the leaders are stationary, the flock will seem indecisive (see Two Leaders video).

4. A smelly bird has its own high value of Ro that causes it to be more repellant to the rest of the flock, but the smelly bird does not care about other birds (other than the leader), it just wants to be at the center of the flock. The rest of the flock does their best to avoid the smelly bird while also maintaining distance from each other (see Smelly video).

5. Forward Euler is compared with Runge-Kutta in the movies titled Euler or RK. In these, the number in the movie's name is the value of h such that if the movie is RK12, then the value of h is 1/12. In these comparisons, Runge-Kutta results in a flock that follows the leader slightly

more and also the flock flies in a tighter formation. As the time step becomes smaller, the grouping of the flock becomes tighter.

6. A predator follows the flock, choosing the closest bird to eat. After each bird it eats, it becomes progressively slower (see Predator video).