

Simu-Ant

The goal of this project is to build an application that simulates ants and their activities. As a simulation the application needs to provide

- A way for the user to set parameters of the simulation
- A view of ant activities as the simulation is running
- A display of values of important parameters such as simulation time, number of colonies
number of ants, number of ants in each colony

Basic Ant Behavior

An ant colony contains queen ants, male ants and female ants. The male ants only fertilize the queen ant when the colony is started. Male ants are born only when they are needed to fertilize the queen. They die shortly after doing so. The queen ant lays the eggs that become the ants in the colony. The female ants are the workers in the colony. There are a number of roles the females fulfill such as forager, feeder and fighter.

A forager ant wanders randomly looking for food. When it finds food it returns to its ant colony and leaves a chemical trail back to the food. Other ants (other workers not foragers) from the colony follow the trail to the food. When an ant follows the trail and finds food it carries it back to the colony. As ants carry food back to the colony they add to the chemical trail. As the chemical trail gets stronger it attracts more ants from the colony. When the food source runs out at the end of the trail the ants wander around looking for the food. The time they wander is proportional to the distance they are from the colony. If they find another food source they take some back to the colony by first going back to the original trail, adding to the chemical trail. If an ant does not find food it does not add to the chemical trail on the way back to the colony. The chemical trail evaporates over time. The weaker it gets the fewer ants it attracts. Eventually the trail evaporates and ants stop following the trail.

When a forager ant wanders for food it will walk over movable items like leaves. There will be times when the chemical trail to food goes over a movable item and the item moves. This creates a break in the trail. When this happens ants will wander randomly. The ants going to the food will wander as if they had reached the end of the trail. The ants coming from the food also wander randomly, but looking for the trail or colony. If they are carrying food they continue to make a chemical trail. If they find the original trail or the colony they form another path between the food and the colony. Ants can get permanently lost and die when the trail gets broken.

When a forager is looking for food it walks randomly. It is not clear how randomly it walks. We will assume that it walk N units forward and then makes a random choice to go left, right or forward. In some species of ants foragers use chemical trails to find their way back to the col-

ony. Other species use the sun's location to find their way back to the colony. We will assume that forager ants know the way back to their colony.

Feeder ants tend to and feed the queen ant and the ant larvae. The more food that is found the faster the colony will grow. When the colony gets large enough it will produce another queen and send her out with male ants to form a new colony. If not enough food is found the colony will stop producing young ants.

We will assume that there are three types of ants: red, black and Argentine. When an ant from one colony gets too close to another colony it is attacked. When ants are attacked or attack they emit a chemical warning that attracts other ants to help. For this project we will assume that red ants are aggressive. It will take two black ants attacking a red ant of the same type (forager, worker, fighter) to kill the red ant. It will take three Argentine ants to kill a red ant of the same type. Otherwise in an attack the red ant will kill the other ant. It takes two Argentine ants to kill a black ant of the same type. Forager and feeder ants have the same fighting ability. A fighter ant is worth two forager or feeder ants. Male ants and queen ants cannot fight. If a red ant meets any ant not from its colony it will try to kill the other ant. If a black ant meets any ant not from its colony it will try to ignore the other ant. Red and black ants will only follow food trails created by ants from their colony. Argentine ants are special. An Argentine ant never attacks another Argentine ant. An Argentine ant will follow any food trail created by any Argentine ant and bring back food to the colony at the end of the trail. If an Argentine ant comes across another Argentine ant colony it joins that colony. All ants eat the same food.

Ants have predators. We will only consider two types of spiders: runners and trappers. Trapping spiders dig a hole in the ground and waits at the bottom of the hole. The hole forms an inverted cone in the ground. When an ant comes the edge of a cone it falls in and tumbles to the center of the hole, where it is eaten by the spider. As the spider grows it can dig deeper and the radius of its cone trap grows. A running spider wanders around looking for ants. Running spiders walk three times faster than ants. When a running spider finds an ant it runs around the ant two times wrapping it in a web. When the ant is wrapped the spider bites it to kill it. A running spider can be killed if attacked by three red ants at the same time. A running spider can "see" an ant at twice the distance that an ant can "see" the running spider. Assume that ant and spiders can only see in the forward direction.

References

The Behavior of Ants, referenced Oct 26, 2010,
<http://biology.arizona.edu/sciconn/lessons2/shindelman/background.html>

Ants, Wikipedia, referenced Oct 25, 2010,
http://en.wikipedia.org/wiki/Ant#Behaviour_and_ecology

While the above references were used parts of the description above were made up. I could not find all the information needed so I just faked it. You should not consider the description above to be factual.