# The simulation.

Our simulation simulates five different species of animals with two predators and three prey, one plant species, one bacterium-based specie in the form of a disease, as well as the environments weather and day night cycle. The five species we decided to simulate in our virtual environment were a jaguar and an alligator which acted as the environment’s predators hunting three prey, the monkeys, frogs and Gazelles, which in turn eat the plants. The Gazelles are hunted by both predators and all organisms excluding plants are susceptible to a disease. An animal has a random chance of catching a disease, which will then take a certain number of steps to kill the animal. Each step after the animal has been infected with the disease, it will have a chance to heal and cure the disease through its immune system. If this is not done within a set number of steps, the animal will die. The animals also have the ability to pass on the disease whilst mating with other animals around it. This does mean that once a species has contracted the disease, it is not possible for the disease to be spread between different species. When walking around the simulated field, prey are able to eat the plants but the predators cannot. As such, they trample the plant destroying it when moving to that space.

Predators wander around the simulated field in search of food, once it comes across a suitable prey within one arbitrary unit of the predators, and it shall be eaten to replenishes the predator’s food. This allows it to continue wandering the simulated field. If the predator does not find enough food, then the predator shall die. If a predator should come across another of its species within a 4 arbitrary unit radius of the predator, it shall attempt to mate with it. If the two predators are of the same species, than they obviously cannot mate, but if they are of two opposing species than they are able to mate and generate a certain number of offspring. During this mating process, it is possible for the uninfected predator to spread a disease to an un-infected predator. The process of movement, feasting and mating only occur during the day. During the night, both predators sleep whilst the prey continue to be active.

Like predators, prey also wander around the simulated fields in search of food, however the food source of all prey is the plant which stays in one place. This plant must occur within one arbitrary unit of the prey for it to beater like the predators, but unlike the predator, the prey eats the plants that they come across instead of trampling them. The prey also looks for mates in the same way the predators do and mate with any opposite sex of the same species within four arbitrary units of the prey. Prey are also able to contract and spread diseases amongst their species through the environment and through mating. Unlike predators, prey do not sleep through the night allowing them to eat and mate. The simulation was designed this way to give prey a chance repopulate, preventing them from dying out.

Plants do not act in the same way as the predators and prey. Instead they have a random chance of growing in a location. Plants also do not breed with one another but instead spread spores in a radius of 15 arbitrary units surrounding the plant. This process does not fill every space within this radius with plants. Instead each plant has the ability to produce 2 seeds each. A random tile on the board is chosen within this radius for the spore to land and germinate. This is done by checking to see if the tile is empty and if it is then the seed can germinate but if there is an animal in the way, the seed gets tramples and destroyed, preventing the plants from growing wildly out of control. Plants are also unable to contract diseases meaning they can only be destroyed when a prey has eaten it, or when a predator tramples it.

An animal also has the ability to catch a disease either from the natural environment of from another animal of the same species. The disease exists within the animals system for several steps giving it a chance to both spread and to be cured. Each animal has a twenty per cent chance of curing the disease. If the disease is not cured within a certain number of steps, the disease kills the animal. As stated above the disease also has a chance of being spread amongst the species through sexual interaction.

# The extensions.

Our application contains one super class called organism that is used to store variables and methods, both abstract and concrete, that are used by bother plants and animals, which both extend the organism super class. The organism class contains five variables, a Boolean called “alive” that marks if the organism is alive or not, an integer value called “age”, that stores the current age of the organism, a Field variable called “field”, that is used to store a reference to the current field the organism exists on, a Location variable called “location”, that is used to store a reference to the location of the organism within the current field, and finally a Random variable called “random”, that is used to store an instance of the random number generator. All four of these variables are used at some point by every organism on the board and as such, we can place them into a super class.

This superclass is extended by two sub classes called animal and plant. The plant class contains all the variables and logic that is used to create a plant. This class contains four final variables and three methods, with none of them being an abstract method. This is because the class is not going to be used as a super to any other classes within the code and as such, the methods need to be concrete in order to construct the plant object. On the other hand, the animal class will act as a super to the five different types of animals within the simulation. The animal class contains four variables and twelve methods, some of which are abstract methods. These methods are abstract methods, just like the Organism class, are used to provide the general framework for the animals, by creating a series of functions that are required for the animal to function correctly, but also allow the developer of the animal class to specialise the functionality of the animal which extends these classes.

The Animal class is then further extended by five seperate animals, all of which are concrete classes. This means that none of the classes are abstract classes and as such they can all be used to create an object from the methods that are currently implemented. As such, these classes are not extended any further.