

Predator and Prey Coursework

Programming Practice and Applications

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Species and Behaviour:

- **Predators:** There exist two predators: jaguars and crocodiles. Predators only breed with their species (i.e., jaguars can only breed with other jaguars). When breeding, the offspring inherits half of the genetic code from each parent. Every integer in the 14-digit gene has a 20% chance of being mutated. Predators spread disease to other animals of their species (i.e., jaguars can only spread disease to other jaguars). Predators can die of old age, starve to death, and die of disease. After contracting disease, predators live for 40 more generations before dying. Predators feed on prey and not on plants. However, when attacking prey, there is a chance that the prey flees, depending on its species.
- **Prey:** There exist three prey: capybaras, squirrels, and deer. Prey only breed with their species (i.e., capybaras can only breed with other capybaras). When breeding, the offspring inherits half of the genetic code from each parent. Every integer in the 14-digit gene has a 20% chance of being mutated. Prey spread disease to other animals of their species (i.e., capybaras can only spread disease to other capybaras). Prey can die of old age, starve to death, and die of disease. After contracting disease, prey live for varying numbers of generations, depending on the species of prey. Prey feed on plants. Prey can flee from the predators and escape being eaten.
- **Crocodile Class:** All the attributes associated with the gene are stored when parsing the gene. The squirrel, capybara, and deer food values are stored at 8, 12, and 15, respectively. The max food level is set to 35, and initially upon creation, the food level is set to the maximum and the age is randomly set. The crocodile ages, gets hungry, tries to give birth (where baby crocodiles are set to have an age of 0), could contract a disease, tries to find food and moves. It can also spread diseases based on their

probabilities. Upon contracting a disease, it stays alive for 40 time generations before dying.

- **Jaguar Class:** All the attributes associated with the gene are stored when parsing the gene. The squirrel, capybara, and deer food values are stored at 8, 12, and 15, respectively. The max food level is set to 30, and initially upon creation, the food level is set to the maximum and the age is randomly set. The jaguar ages, gets hungry, tries to give birth (where baby jaguars are set to have an age of 0), could contract a disease, tries to find food and move. It can also spread diseases based on their probabilities. Upon contracting a disease, it stays alive for 40 time generations before dying.
- **Capybara Class:** All the attributes associated with the gene are stored when parsing the gene. The plant food value is stored as 3, and the max food level is stored as 15. Upon creation, the food level is set to the maximum, and the age is randomly set. The capybara ages, gets hungry, tries to give birth (where baby capybaras are set to have an age of 0), could contract a disease, tries to find food and move. It can also spread diseases based on their probabilities. Upon contracting a disease, it stays alive for 30 generations. It also contains a flee method, where the capybara can flee from a predator with a probability of 0.2.
- **Squirrel Class:** All the attributes associated with the gene are stored when parsing the gene. The plant food value is stored as 3, and the max food level is stored as 12. Upon creation, the food level is set to the maximum, and the age is randomly set. The squirrel ages, gets hungry, tries to give birth (where baby squirrels are set to have an age of zero), could contract a disease, tries to find food, and moves. It can also spread diseases based on their probabilities. Upon contracting a disease, it stays alive for 10 generations. It also contains a flee method, where the squirrel can flee from a predator with a probability of 0.4.
- **Deer Class:** All the attributes associated with the gene are stored when parsing the gene. The plant food value is stored as 3, and the max food level is stored as 20. Upon creation, the food level is set to the maximum, and the age is randomly set. The deer ages, gets hungry, tries to give birth (where baby deers are set to have an age of 0), could contract a disease, tries to find food and moves. It can also spread diseases based on their probabilities. Upon contracting a disease, it stays alive for 20 generations. It also contains a flee method, where the deer can flee from a predator with a probability of 0.4.
- **Plants:** Plants are illustrated by green blocks. Plants regrow every five generations. Initially, there are 5000 plants. However, a maximum limit of 3000 is then imposed. Once the plant count falls below 3000, it cannot exceed this limit again. Predators bite plants, causing them to die after 10 bites. Plants grow over dead animals. Eventually, after all animals become extinct, the plants begin to die, which decreases the plant count below 3000, at which point it breeds again rapidly. This cycle is continued for the rest of the generations.

Extension Tasks Implemented:

Extension Task 1: Legend/key

- **Description:** A legend or key at the bottom of the SimulatorView window shows the different coloured representations of each animal.
- **Implementation:** Added a method to create the legend, added another method to group the coloured box with the label, and added a third method to place the legend at the very bottom of the GUI. All of this was done in the SimulatorView class.
- **Effect on Simulation:** Allows for easier understanding of the grid.

Extension Task 2: Plant growth

- **Description:** Each plant dies after it has been bitten more than 10 times as well as regenerates every five generations.
- **Implementation:** Added a method that increments the number of bites when a prey “eats” it. Implemented a method that grows the plant, decreasing the number of bites that have been taken out of it.
- **Effect on Simulation:** Allows for plants to slowly regrow as time goes by as well as die gradually and not at once, mimicking an actual ecosystem.

Extension Task 3: Plant asexual reproduction

- **Description:** Plants reproduce on their own over time.
- **Implementation:** Introduced a pollination method along with a method that controls the number of seeds.
- **Effect on Simulation:** Prevents the plants from dying out completely and causing the animals to starve.

Extension Task 4: Prey fleeing

- **Description:** Prey occasionally can flee from the predators.
- **Implementation:** Created a flee method in the Animal class which sets a boolean by probability, depending on the species. The method is used in combination with the predator classes; if the prey is alive and the flee method returns True, the prey gets eaten. Prey have differing probabilities of fleeing depending on the nature of the animal. For instance, a deer is more likely to escape than a capybara or a squirrel given their speed.
- **Effect on Simulation:** Slightly decreases the death rate of prey.