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Homework 6 – Artificial World

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Dina’s world design and sustainability analysis:

**Design:**

This world is set on four different terrains – field (land), forest (two regions of forests), pond, and mountains. There are ten types of creatures: foxes, dragons, leprechauns, bunnies, clovers, unicorns, crocodiles, fish, bees, and lavenders. A timer is created so that events happen every second. Every event, the creature’s age increases by 1 and they either die (if age is equal to dying age) or they go search for food/mates (if they have passed their age of maturity). If no food/mates are found in the field of vision (hard-coded to 70 pixels), the creature moves their designated speed in a random direction. The starting number of each creature, dying ages and maturity ages are all set through a file that the user inputs (chooses one out of a select available number).

When hunting or looking for mates, creatures follow the desired creature in their field of vision until they come close enough to either eat it or reproduce with it, respectively. Reproducing means that a new creature of that type appears next to the two creatures mating.

While having a set reproduction and dying age, creatures increase their dying age by 5% (meaning they live longer) and decrease their reproduction age by 10% (making them more likely to reproduce) when eating, which they do until they hit the reproduction age. Once that age is hit, creatures start looking for mates and once they have found one, their reproduction age increases four-fold, so that they do not reproduce for a while (this does not affect bees, which do not have a reproducing age 🡪 see description below).

Creatures stay in their respective regions with the following characteristics:

**Foxes:** hunt bunnies, stay only in the forests, mountains and field regions, and have a speed of 11 pixels per timer tick.

**Dragons:** hunt leprechauns, can fly anywhere except for the forests and have a speed of 13 pixels per timer tick.

**Bunnies:** eat clovers and lavenders, stay only in the field and forests, and have a speed of 14 pixels per timer tick.

**Leprechauns:** exist everywhere except for the pond and have a speed of 14 pixels per timer tick. Leprechauns are different in that they appear at a random point in the world (where allowed to exist) every certain number of timer ticks (this value is set in the input file). They do not eat, but they do plant clovers in their path every certain number of ticks (also set in the input file).

**Clovers:** planted by leprechauns, can only exist in forests and the field, do not move.

*New creatures:*

**Unicorns:** eat lavenders, exist only in the forests, and have a speed of 10 pixels per timer tick. Unicorns have a unique ability of being able to go through a secret portal, the entrance to which is found in each forest. If a unicorn gets closer to a portal than its speed, it is automatically teleported to appear next to the other portal.

**Crocodiles:** hunt fish and bunnies, exist only in the pond and field, and have a speed of 11 pixels per timer tick.

**Fish:** exist only in the pond, have a speed of 5 pixels per timer tick.

**Bees:** can exist anywhere on the map, have a speed of 20 pixels per timer tick. Like leprechauns, bees do not feed on anything but rather plant lavenders on their path every certain number of timer ticks (set in the input file). Bees can only reproduce in the forest, where they can make hives. Every timer tick a bee is in a forest, it has a 1/10 chance of producing a new bee. Also, when in close range to an animal (30 pixels), there is a 1/5 chance that the bee will sting the animal and both the animal (includes crocodiles, foxes, dragons, unicorns, fish, bunnies and leprechauns) and the bee will die.

**Lavenders:** planted by bees, can only exist in forests and the field, do not move.

**Sustainability:**

*World1:* A world with slightly more herbivores than carnivores, with herbivores having a longer lifespan than carnivores, leads to a relatively good balance of creatures. However, in the end, the world is left with mainly bunnies and dragons. This occurs due to the characteristic that the leprechaun continues to show up every so often. Dragons feed on the leprechauns and bunnies feed on the clovers that the leprechauns leave behind. While the rest of the creatures are either eaten or run out of food and starve, these two continue to survive the longest.

*World2*: A world starting with majority carnivores and with carnivores having a longer lifespan does, predictably, lead quickly to an imbalance where herbivores are wiped out. However, even though the foxes and crocodiles remain with no more food, the balance between them and dragons (which get food via the appearing leprechauns) remains exceptionally stable. This is most likely due to all of the creatures reaching past their reproductive age and existing in large groups (due to new creatures appearing right next to their parents and by statistics, continuing to stay near them). Therefore, even as some die, others continue to reproduce and maintain the population.

*World3*: On the other side of the spectrum, a world with a significant majority of herbivores with longer life spans leads to a good balance in terms of creatures dying out evenly (with only unicorns dying out quickly – due to the statistical unlikeliness of lavenders appearing in the forest). However, a few runs of this world showed that in this situation, a lot is due to chance – one time the world was left with bunnies and foxes, but another time, a lot of bees happened to be near the forest and reproduced so quickly that they were the only creatures left.

*World4:* To disrupt the imbalance in *World1* caused by an advantage of bunnies and dragons over the other creatures, a world with much fewer dragons and bunnies was tested. In this case, the dragons and bunnies actually died out very quickly, indicating that their main advantage comes later, when the other creatures run out of food. The result of this simulation also proved to vary, as in one, the product was mainly foxes and crocodiles, but in another, the bees again were the majority.

*World5:* By increasing the number of fish, unicorns and bunnies, decreasing the number of dragons and crocodiles, and increasing the frequency of appearance of clovers, leprechauns and lavenders, a rather sustainable world was able to be achieved, with all of the creatures existing for a significantly longer than in the other worlds. The reason this combination works is that this world provides food for all of the creatures to give them an equal advantage both in the beginning and at the end.

*World6:* A world with the majority of a single animal and its food (such as bunnies and clovers) does not work because they continue to be the majority for the entire time and continue to reproduce faster than they die out.

In the end, World5 was the most sustainable world. However, under the conditions and properties set for these creatures, it can often be unpredictable and results may vary from simulation to simulation.