Excercise 1.
Implementing a first Application in RePast: A Rabbits Grass Simulation.

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1 Implementation

1.1 Assumptions

Some of the assumptions of our world model is latent bounded in the requirements in programming the same simulation model. Thus, most scenarios are takenhttps://www.overleaf.com/project/5bae21f03a64ef4c795831b1 into account but some assumptions are made, mostly in a user-related setting:

- **Re-entering parameters:** The model will not get new parameter settings while in a running state. E.g the grid size can't be changed during a run.
- **Grass growth rate and initial number of rabbits:** Assumes that the user do not set the initial number of rabbits and growth rate of grass too high and the grid size too small.
- **Random generation:** The values generated in the math.random() function of java is sufficiently fulfilling the requirements of our simulation model.

1.2 Implementation Remarks

The world model is built to satisfy the most important requirements when creating rabbit grass simulation:

- **The grid:** The grid is implemented with a default of 20 x 20. Furthermore, a slider in RePast is connected to the grid size, thus the grid size could be changed before running the simulation. The grid is also a torus, i.e. the world has no borders or edges.
- **Collision:** The rabbits can not stay on the same cell, i.e collide. This is implemented by giving both the agent class and the space class knowledge of the different space cells. Thus, no agents will go to any space cell with another agent in it. Specifically this is prevented when the agents are added in the space class. If a collision occur, the rabbit that tried to move into the square of the other rabbit will stay in the same square and move another direction in the next step.
- **Model Parameters:** The platform will correct for invalid user input. E.g: negative, too low or too high grid size values.
- **Graphs:** The graphs shows the amount of rabbits and the amount of grass patches in the grid. It does not show the total amount of energy in all the patches of grass.

2 Results

For all experiments with our Rabbits and Grass model some of the parameters will be the same and other will vary. The variables that are the same for all experiments with their corresponding variable name and values are:

- **Number of agents - numAgents:** 10. Although this parameter has a corresponding slider and is possible to change before executing the simulation, it will stay the same for all experiments.
- **Total grass at the start of a new simulation - grass:** 100
- **Minimum lifespan of a agent - agentMinLifespan:** 30
- **Maximum lifespan of a agent - agentMaxLifespan:** 60
- **Start energy of agents - agentStartEnergy:** 50
- **Energy needed for reproduction - energyToReproduce:** 70. Although this parameter has a corresponding slider and is possible to change before executing the simulation, it will stay the same for all experiments.
- **Cost of reproduction - costOfReproduction:** 30
- **Energy in grass - energyInGrass:** 10. The energy in the grass will be 10, 20 or 30 when this parameter is set to 10. It might get multiplied by 1, 2 or 3 each with the same probability.
- **Grow rate of the grass - grassGrowthRate:** 10. Although this parameter has a corresponding slider and is possible to change before executing the simulation, it will stay the same for all experiments.
- **Cost of a agent movement - costOfMovment:** 1

The only variables that will be changed in our two experiments will be the grid size in the X and Y directions.

2.1 Experiment 1

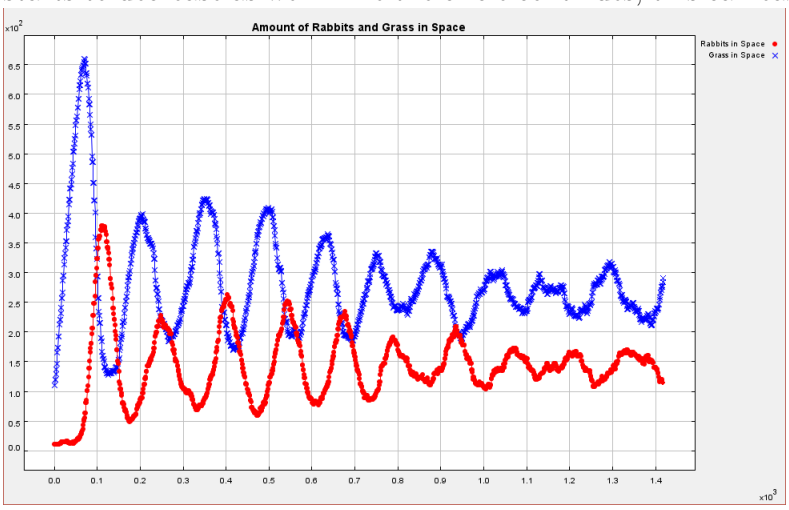
2.1.1 Setting

For this experiment the grid size will be 50x50.

2.1.2 Observations

In this experiment we can see that since there is so few rabbits in the space the grass growth rate is almost linear, 10 grass per step. The space starts to fill with grass and the probability for a rabbit, that moves around blind, to find a patch of grass to eat increases. Then the rabbit population starts to increase. The consequences of this is that the amount of grass in the space starts to decrease rapidly. As the amount of grass decreases, the rabbit population will be to big to be sustainable and the population

starts to decrease as well. The the circle continues, this can easily be seen in the graph in this subsection.



2.2 Experiment 2

2.2.1 Setting

For this experiment the grid size will be 70x70.

2.2.2 Observations

In this experiment we wanted to see how the rabbit population would evolve on a 70x70 grid. In the start we can see that the rabbit population almost dies out because the probability of finding a patch of grass when moving around blind is lower than in experiment 1. This is because of the bigger grid. But as the amount of grass increases sufficiently before all the rabbits are dead, the population starts to grow again. We can see the same trends and life cycle of the simulation here as in experiment 1. Except a slightly lower rabbit population over time, due to the before-mentioned lower probability to find grass. This is also why the amount of grass so high.