Foxes and Rabbits

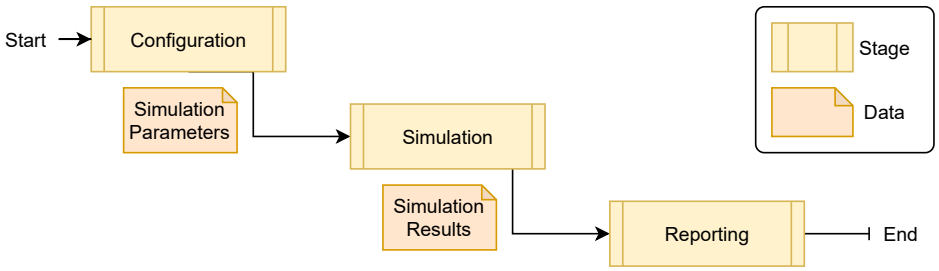
Phase 1

Exam 2021 - Group Project

DM536 Introduction to Programming
DM562 Scientific Programming
DM857 Introduction to Programming
DS830 Introduction to Programming

Functionality

In this phase of the project you will implement the top layer of the program which consists of 1. the high-level flow of the program and 2. simulation setup. The flow of the program is organised in three main stages: configuration, simulation, and reporting. The diagram below provides a schematic overview of flow through the three stages together with the data they expect and produce (simulation parameters and simulation results).



The simulation configuration consists of the following parameters.

- Parameters for the 2D surface where foxes and rabbits live:
  - shape (can be either toroid or island);
  - north-south length (positive);
  - west-east length (positive).
- Parameters for the fox population:
  - initial size (smaller or equal to the surface area);
  - maximum age a fox can reach;
  - maximum level of energy;
  - metabolism
  - probability of reproduction;
  - minimum age required for reproducing;
  - minimum energy required for reproducing.
- Parameters for the rabbit population.

  - initial size (smaller or equal to the surface area);
  - maximum age a rabbit can reach;
  - maximum level of energy;
  - metabolism
  - probability of reproduction;
  - minimum age required for reproducing;
  - minimum energy required for reproducing.
- Parameters for the simulation process.
  - maximum number of steps;
  - delay (seconds) added to each step;
  - modality (can be either visual or batch).

For convenience, the program starts by assigning default values to all of these parameters and offers to the user both an "advanced" and "quick" setup procedure. Using the first, users specify values for every parameter and using the second they specify only the values for the following parameters:

- size of the world;
- initial size of each population;
- maximum number of simulation steps;
- simulation modality.

The diagram in Figure 1 details the high-level flow and interaction with the user in each stage. The diagram contains three types of blocks: actions (performed by the program, e.g., printing), action selections (the user selects how to proceed), and data input (the user inputs data e.g., the shape of the world). Some actions are also marked as "mock" meaning that they consist of some place-holder implementation that will be refined to the expected full functionality in the later phases of the project (e.g., the actual simulation is implemented in Phase 2).

Structure

The program is organised in four modules (more will be added in the next phases) as shown in Figure 2. Module `foxes_and_rabbits` is the main module of the program (and the focus of this phase). It is the module that implements the top layer of the program functionality (Figure 1). Module `parameters` offers a number of classes for storing the parameters of the simulation. For this phase, you can find an (obfuscated) implementation of this module on the Course Material together with this document. Module `simulation` offers a function that handles the simulation phase. Module `reporting` offers a number of functions for analysing and visualising the data collected during the simulation phase. The last two modules cover functionalities that you will implement in the next phases. Instead, for this phase, you will use *mock* implementations of modules `simulation` and `reporting` (you can find them on the Course Material together with this document).

Milestone 1

Module `foxes_and_rabbits`.

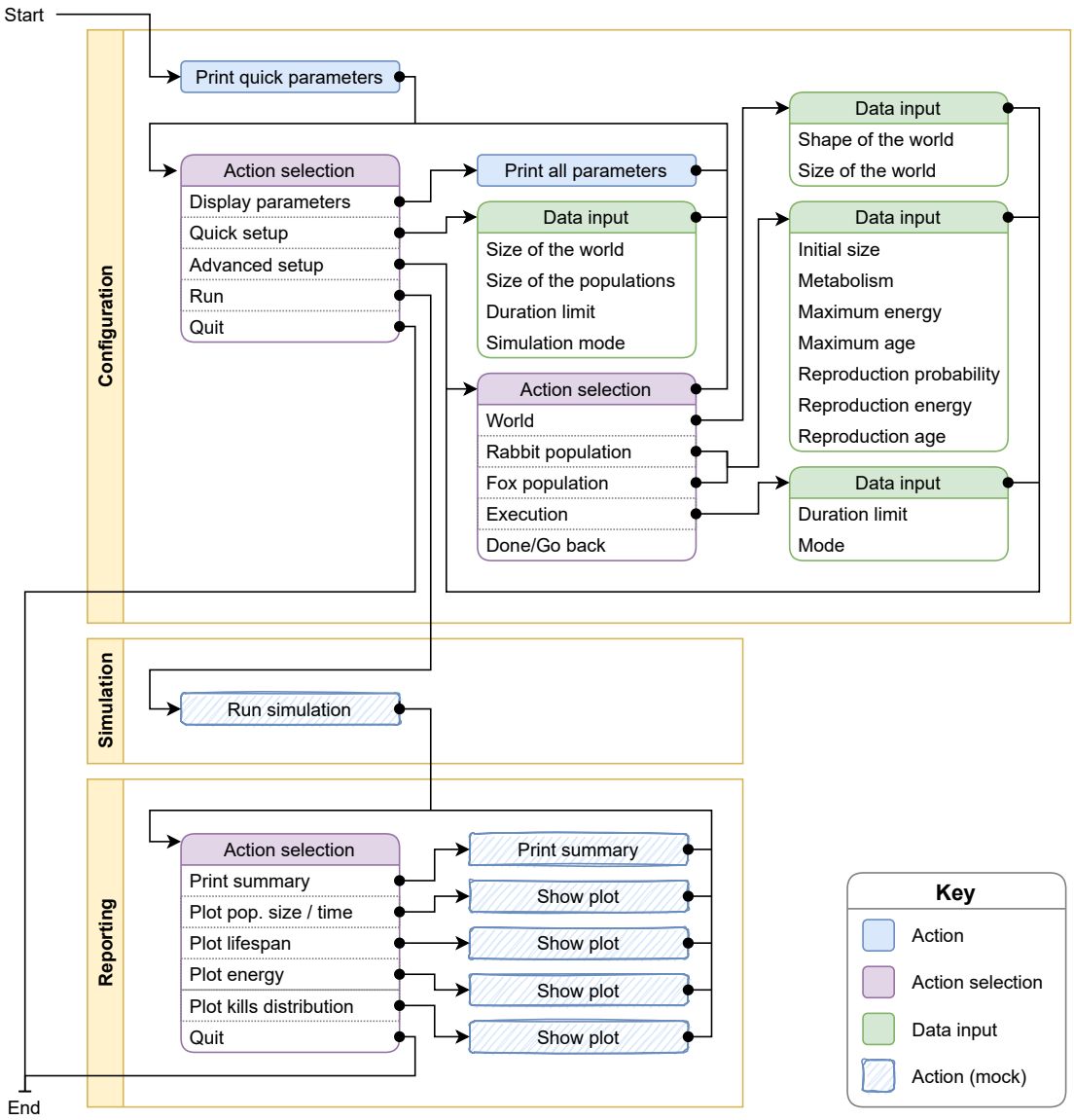


Figure 1: Functionality - Phase 1.

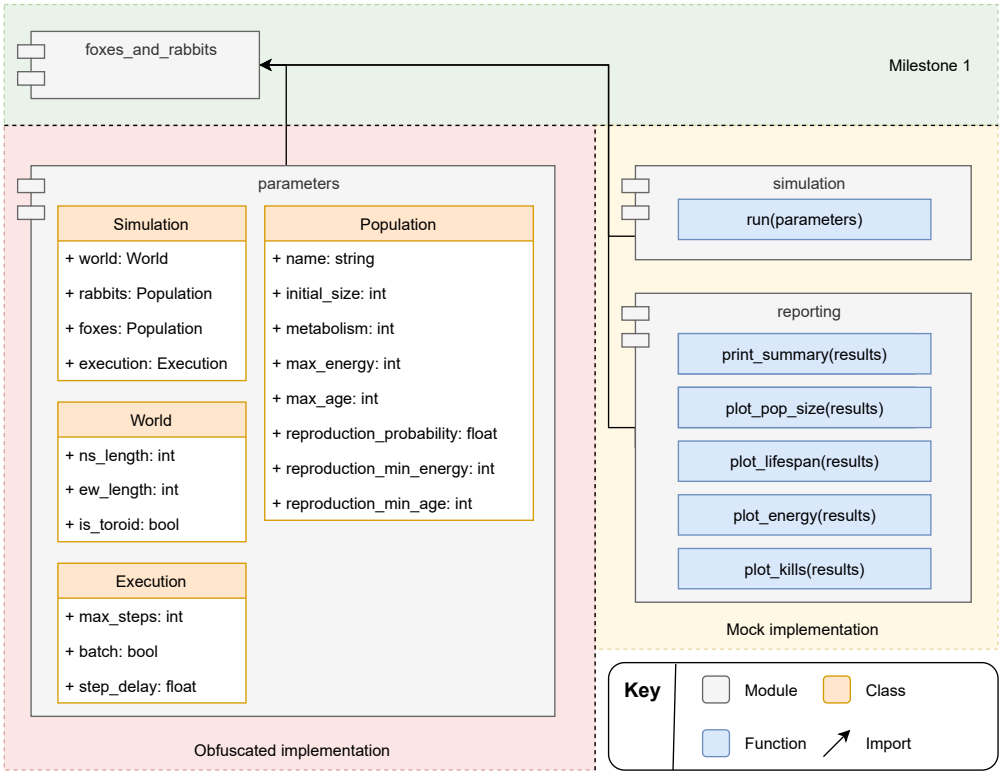


Figure 2: Structure - Phase 1.

Hand-in

You must hand in a zip file containing:

- A PDF document named `report.pdf` containing your report.
- A file `foxes_and_rabbits.py` containing your implementation of module `foxes_and_rabbits` and the top layer of the program.

The name of the zip file must be the name of your group.

The report must be written in English and delivered as a single PDF file printable in black and white, long at most 15 pages excluding front and back matter e.g., an appendix (te examiners are not required to consider appendices or anything above the page limit in their evaluation). The report must include the name of the group and its members (name and SDU email where applicable).

Your code must follow the structure detailed in this document, be documented, and adhere to the common coding conventions and rules of Python and this course. For this phase you can use any module in the standard library of Python (third-party modules and packages are not allowed).