User Guide

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Overview

A requirement for this Assignment was to create a program that will simulate the Reproduction and lifecycle of brine shrimp. **ShrimpSimBase.py** does exactly that. This program consists of varying variables and parametres that were manipulated and used to visualize the lifecycle of brine shrimp namely those being the **Population**, **Timestep**, **Xvalues** and **Yvalues**. Users were able to test out this simulation using varying numbers to identify the differences in each simulation. Users will be able to identify the varying life stages of the shrimps by the different representation of the plots in the scatter plot. **ShrimpSimBase.py** was designed to be run using default inputs from the program, command line parametres and file input.

How to Use Simulation

1. ***To use this simulation with Default Inputs***

   ```
   python3 shrimpSimBase.py
   ```

2. ***To use this simulation with Command Line Parametres***

   ```
   python3 shrimpSimBase.py 200 100 1000 20
   ```

   where:

   200 →is the **Xvalues** variable and the maximum x value of the scatter plot

   100 → is the **Yvalues** variable and the maximum y value of the scatter plot

   1000 →is the **Population** of shrimps in the fish tank (scatter plot)

   20 → is the **Timestep** and the number of times we will step through the life cycle of the shrimps

3. ***To use this simulation with File Input***

   ```
   python3 shrimpSimBase.py input.txt output.txt
   ```

   where:

   input.txt → the input file that contains the parametres to run the simulation

   output.txt → is the output file in which the shrimps most recent state will be written out to a text file

4. ***To use this simulation with a Parametre Sweep***

```
./shrimp_sweep.sh 100 200 100  100 200 100 50 300 50
```

where:

100 200 100 → is the low, high and step value for the Y coordinates

100 200 100 → is the low, high and step value for the X coordinates

50 300 50 → is the low, high and step value for the shrimp population

In Depth Overview of Code:

ShrimpSimBase.py

This is the main file that supports all the other classes. **ShrimpSimBase.py** contains the two most important functions. The first one being the main which deals with all the input validation from users and ensures that no invalid parametres were passed in. The main function passes all the parametres received whether it be from a file or command line parametres to be validated to ensure that the program runs smoothly. The main also includes various try-catches to handle any exceptions that may occur within the duration of the program running. This ranges from errors where a user may have inputted a string instead of a number to a file name not existing in the directory. The second function encapsulated within this file would be `Simulation(XMAX, YMAX, POPULATION, TIMESTEP)`. This function handles the creation of all the shrimps and appends them to a list. While the loop is creating the shrimp objects, random x and y coordinated are being assigned to each shrimp. Once the shrimps are created, they are then checked in every **Timestep** to identify if they collide and mate and their current state. Finally, they are all plotted and displayed as a scatter plot.

Check.py

Check.py includes various functions that were being used to detect collisions as well as supporting functions that validate the coordinates, gender and state of a shrimp. The `checkCollision(shrimpList,shrimp)` function identifies whether any shrimps are colliding and does so by detecting whether any two shrimps are located in the same coordinate, both of the opposite gender and whether they are both adults. If all conditions are met then the Shrimps will reproduce and lay an egg.

UserInput.py

UserInput.py is a simple file that is used to display information to users on how to use the program in many ways by displaying statements to the terminal screen and showing examples of how the program must be run. A welcome banner is also displayed in the beginning of the program that details the default parametres that will be used. Other functions included in this file involve the user selection an option on whether they would like to run the simulation with default values or would like more information on how to customize the experiment.

FileIO.py

FileIO.py is an extra feature that I have included in my simulation program. Users can include all their customizable parametres in a single file and just run the program as mentioned above. For better clarity I have also included the option for users to display the states and coordinates of the shrimp objects to a file so that they are better able to find and analyse the shrimps that were appended to the list. Exception handling was also utilized in this file to ensure that all Input and Output that was occurring efficiently and as smoothly as possible.