

Lab 06b: Fantasy Garden, Part 2

COSC 102 - Spring '24

Goal: For the next part of this lab you will continue to gain practice with polymorphism and as well as two-dimensional arrays.

1 Overview

In the first half of this lab, you implemented various `Plantlet` types which leveraged different inheritance relationships. For second half of this lab, you will implement the `FantasyGarden`, which maintains a collection of `Plantlets` as well as the code that runs a simulation on said garden.

The simulation runs for a fixed number of days, with each day having randomized weather conditions. Each day, the simulation will report the status of the garden, including each `Plantlet`'s daily activity with regard to growth, wilting, and being eaten.

1.1 The Fantasy Garden

The **FantasyGarden** is where `Plantlets` are planted and grow. The `FantasyGarden` stores these `Plantlets` in a **two-dimensional `Plantlet` array**.

You can think of this 2D array as a grid of a grid of *plots* – At instantiation, `FantasyGarden`'s constructor accepts a set of dimensions (rows and columns), with each "cell" of the garden representing one plot. Each plot can hold a single `Plantlet` and, as days pass, the `Plantlets` in the garden grow.

1.2 The Simulation

`FantasyGarden` has a method `runSimulation(int numOfDay)` which simulates a specified number of days in the garden, and prints the activity and status with regard to each of the garden's `Plantlets` at the end of each day.

On each day of the simulation, the following happens:

1. Randomized weather conditions are chosen (explained below) and printed.
2. All `Plantlets` in the garden attempt to grow. Their growth activity (including if they didn't grow, wilted, or were already wilted) is printed.
3. Once *Step #2* is completed for all `Plantlets`, the simulation determines if any `AnimalEdible` `Plantlets` get eaten. This determination is made via a random "dice-roll" per that `Plantlet`'s respective "eat chance".
4. A grid of the garden 2D array is printed, with each "plot" displaying its respective `Plantlet`'s `toString` info.
5. The above four steps then repeat for each day of the simulation.

Below is an example output of one day from the simulation (assuming a `FantasyGarden` with 3 rows, 4 columns, and 6 `Plantlets` planted). An example of a full simulation's output is provided at the end of this document:

```
*** DAY 4 ***
Today's temp is: chilly. There is: no sun, and it is: raining
  Plantlet at row: 0, col: 0 is wilted!
  Plantlet at row: 0, col: 1 grew by: 9 GU!
  Plantlet at row: 0, col: 2 grew by: 15 GU!
  Plantlet at row: 0, col: 3 grew by: 1 GU!
  Plantlet at row: 1, col: 0 wilts!
  Plantlet at row: 1, col: 1 is wilted!
  Animals ate the plantlet at row: 0, col: 3!

Garden state at end of day 4:
[FR WILT] [WW 90%] [WW 95%] [KB 0%]
[KP WILT] [FR WILT] [      ] [      ]
[      ] [      ] [      ] [      ]
```

1.3 Simulated Weather

Each day of the simulation, a randomized set of weather conditions are chosen. Specifically, each day:

- a random **temperature** is chosen, with all three temperatures (*chilly/warm/hot*) being weighted equally
- a random **is rainy?** value is chosen, with both outcomes weighted equally at 50/50
- for **is sunny?**:
 - if the day *is* rainy, then it is **not sunny**
 - if the day *is not* rainy, then a random value is chosen, with both outcomes weighted equally at 50/50

One final factor: due to its tall height and canopy, any Plantlet in the garden within **one plot** of a **SoakOak** will always have conditions of **no rain** and **no sun** regardless of the randomized weather. Temperature is unaffected.

This applies to any Plantlet one plot away from a SoakOak horizontally, vertically, or diagonally. A SoakOak itself is not affected by this. Likewise, a SoakOak in proximity to another SoakOak is not affected.

The below image gives a visualization of this effect. The example garden contains three SoakOaks – the plots in **red** will always have conditions of *no sun* and *no rain* due to their proximity to a SoakOak.

		Column					
		0	1	2	3	4	5
Row	0	SO	KB	WW	KB	FR	FR
	1	FR	KP	FR	FR	KB	KB
	2	KP	KP	WW	SO	FR	WW
	3	WW	KB	SO	WW	WW	FR

Key

- receives the normal, randomized weather conditions
- is covered by a SoakOak, thus **only** uses the randomized temp. These Plantlets never receive sun or rain.

2 Your Task

Provided to you are **two** files: **GardenClient.java** and **FantasyGarden.java**. You will use GardenClient to test your various FantasyGarden methods and simulation. All of your implementation code will go in FantasyGarden.

FantasyGarden has following features are **already implemented for you**:

- a 2D Plantlet array instance variable storing the contents of the plots in the FantasyGarden. The dimensions represent rows and columns respectively (*i.e.*, `FantasyGarden[2][4]` is the plot at row 3 column 5)
- a **toString()** which prints the state of the FantasyGarden (trace/test this method to see what it gives you!)

You must implement some or all of the following:

- the **constructor**. Invalid argument(s) use the default minimums.
- the **plant(Plantlet toPlant)** method, which attempts to plant the argument `Plantlet` in the next available plot. Empty plots are filled left-to-right, top-to-bottom. This method returns a **boolean** indicating if the `Plantlet` could be planted or not (a null argument should return false... there's one other false scenario)
- the **runSimulation(int numOfDay)** method, which simulates the state of the `FantasyGarden` over the course of the argument number of days and displays each day's results as outlined in *Section 1.2*.

There are many different (and repeatable) tasks in this simulation – don't forget about your **SOFA** principles!

3 Submission

Upload your work to the **Lab 06b** submission on your lab Moodle. Submit the following **eight** .java files:

1. `FantasyGarden.java`
2. `FlubFlubRoot.java`
3. `GardenClient.java`
4. `KupoBerry.java`
5. `KupoPrickle.java`
6. `Plantlet.java`
7. `SoakOak.java`
8. `WibbleWort.java`

Do not submit `AnimalEdible.java` or `PlantletClient.java`.

This lab is due:

- **Tuesday, March 26th** by **5:00 PM** for lab sections **A, B, and C** (which meet on Wednesday)
- **Wednesday, March 27th** by **5:00 PM** for lab sections **D, E, and F** (which meet on Thursday)

4 Sample Simulation Output

On the next page is an example output of `runSimulation(...)`. This example call to `runSimulation(...)`:

- references a `FantasyGarden` that's **2 rows x 4 columns**, with the following `Plantlets` planted **in this order**:
 - a `FlubFlub Root`
 - a `Kupo Berry`
 - a `Wibble Wort` (with a grow range of 7)
 - a `Kupo Prickle`
 - a `Soak Oak`
 - a `Wibble Wort` (with a grow range of 10)
- is being passed an argument of **4 days**

Your output **must** contain all the same information and formatting:

*** DAY 1 ***

Today's temp is: hot. There is: sun, and it is: not raining.

Plantlet at row: 0, col: 0 grew by: 4 GU!
Plantlet at row: 0, col: 1 grew by: 1 GU!
Plantlet at row: 0, col: 2 grew by: 5 GU!
Plantlet at row: 0, col: 3 grew by: 3 GU!
Plantlet at row: 1, col: 0 grew by: 1 GU!
Plantlet at row: 1, col: 1 grew by: 2 GU!
Animals ate the plantlet at row: 0, col: 1!
Animals ate the plantlet at row: 0, col: 2!
Animals ate the plantlet at row: 1, col: 1!

Garden state at end of day 1:

[FR 36%] [KB 0%] [WW 0%] [KP 20%]
[SO 5%] [WW 0%] [] []

*** DAY 2 ***

Today's temp is: hot. There is: sun, and it is: not raining.

Plantlet at row: 0, col: 0 grew by: 4 GU!
Plantlet at row: 0, col: 1 grew by: 1 GU!
Plantlet at row: 0, col: 2 grew by: 7 GU!
Plantlet at row: 0, col: 3 wilts!
Plantlet at row: 1, col: 0 grew by: 3 GU!
Plantlet at row: 1, col: 1 grew by: 3 GU!
Animals ate the plantlet at row: 0, col: 2!
Animals ate the plantlet at row: 1, col: 1!

Garden state at end of day 2:

[FR 72%] [KB 6%] [WW 0%] [KP WILT]
[SO 23%] [WW 0%] [] []

*** DAY 3 ***

Today's temp is: warm. There is: no sun, and it is: raining.

Plantlet at row: 0, col: 0 grew by: 2 GU!
Plantlet at row: 0, col: 1 grew by: 1 GU!
Plantlet at row: 0, col: 2 grew by: 5 GU!
Plantlet at row: 0, col: 3 is wilted!
Plantlet at row: 1, col: 0 grew by: 1 GU!
Plantlet at row: 1, col: 1 grew by: 5 GU!

Garden state at end of day 3:

[FR 90%] [KB 13%] [WW 22%] [KP WILT]
[SO 29%] [WW 22%] [] []

*** DAY 4 ***

Today's temp is: warm. There is: no sun, and it is: not raining.

Plantlet at row: 0, col: 0 grew by: 1 GU!
Plantlet at row: 0, col: 1 grew by: 1 GU!
Plantlet at row: 0, col: 2 grew by: 7 GU!
Plantlet at row: 0, col: 3 is wilted!
Plantlet at row: 1, col: 0 grew by: 3 GU!
Plantlet at row: 1, col: 1 grew by: 6 GU!

Garden state at end of day 4:

[FR 100%] [KB 20%] [WW 54%] [KP WILT]
[SO 47%] [WW 50%] [] []