

## Assignment 5

### Design Patterns

Screencast link: <https://youtu.be/R4XnfzDxY64>

#### Technical Design

This program is a multithreaded program (more on that later). The program uses the Singleton design pattern for 3 classes, the Player class—the pseudo player that *controls* the simulation—, the Kampfarena class—the battle arena that makes world announcements and stores the trainers participating in battle—, and the WildeLandMediator class that mediates the World between day and night, the weather, and in-game time. Additionally, the program uses the Abstract Factory design pattern to build Trainers and Monsters. It uses the Mediator design pattern as the described previously (it combines with the Singleton). It also uses the Decorator design pattern to decorate Monsters turning into Code-a-mon upon being tamed by a Trainer and improving their stats (not enough time to implement it but could also be used for evolutions), the pattern is also used to decorate the Day and Night classes with environmental effects from the weather.

Now, regarding the multithreaded environment, a parallel thread runs in synch with the main thread. The main thread keeps track of the in-game time and the weather using that thread. The in-game time is designed as follows: [d:t:c] where d is the day, t is the time, and c is the counter. A day is split in 4 times, and a time is split into 16 counters. A counter is one real-world second. Everything begins at 0, so the time in-game is told as: Night [2d:3t:5c] read as Night on the 2<sup>nd</sup> day, 3<sup>rd</sup> time, and 5<sup>th</sup> counter. The game start during the day at 0d:1t:0c and continues until 7d:3t:15c, or until a last trainer is standing—Day time is from 1t-2t, Night time is from 3t-0t. Only one trainer may win, so the fighting will continue until that last day (there is a special event if that case occurs). While this thread increments the clock and changes the weather, the main thread keeps checking in to determine which actions the Trainers may take, or if any boosts may be applied to their Code-a-mon.

The Mediator is intertwined with the Decorator with respect to the weather. When the mediator determines it is night it has the WildeLandDecorator class decorate that time with weather. It then announces the weather to the program, where the main thread may then make updates as needed. The AbstractFactory is intertwined with the MonsterDecorator class in that they share base concrete classes, one that the factory creates, and the same decorated by the decorator.

There is also a special customized design pattern I created called the Narrator, which takes advantage of the multithreaded environment and in-game timer. This package works by the day and narrates parts of the simulation, particularly in the beginning on day zero. The Mediator keeps checking the narrator and prints any predetermined narratives to the screen.

#### Simulation Summary

The day start at [Day 0d:1t:1c], the in-game clock described in the second paragraph above. Two trainers are created Dock and Tomm. On day zero they may not fight in the Arena as it is the opportunity for them to tame monsters. If they *decide* to tame monsters, they

explore the Wilde Land and tame monsters. When a monster is tamed, it becomes a Code-a-mon, in which case it gains a type, skills, and its attributes increase.

Depending on the weather, the Code-a-mon may have a bonus stat which has effects in battle (it also has effects at night which was not implemented due to time constraints). From 3t-0t, trainers may not register for battle at the Kampfarena—during this time, they may sleep or explore for more Code-a-mon (expect for at 0t where it is considered too dangerous). From 1t-2t the Trainer may not sleep but may instead register for battle or explore the Wilde Land. If in battle and a winner is not declared by 3t, the battle ends, and the trainers must register for the next day at 1t to continue the battle. If they did not sleep, which recovers HP and MP, they enter the battle with the same they left battle the day prior.

During battle, the Code-a-mon may attack with skills or normal attacks and the, and the Trainers with Code-a-mon or normal attacks. When a trainer is attacked, the choose the first alive Code-a-mon and defend with the Code-a-mon. If the trainer has no more Code-a-mon, the Trainer takes the hit. When the last trainer is standing, they are declared the Champion and the game ends.

#### **I. Requirements Fulfilled**

1. The new world starts with 2 trainers begins with at least one code-a-mon.
2. Trainers can acquire more than 1 Code-a-mon for a max of 6.
3. Code-a-mon compete 1v1, but in this case are considered more of an extension of their Trainer so must be called every turn.
4. The simulation runs on cycles. A day lasts 32 seconds, and a night lasts 32 seconds.
5. Each Day and Night has weather events
6. Each weather event has an effect on specific Code-a-mon.
7. Code-a-mons' gain advantages or disadvantages based on the skills types used against them, or the skills they use on others if it matches their type.
8. Battles may only start during the day but may last for up to 16 seconds into the night, which are then stopped for the final 16 seconds of night if there is not a victor and are picked back up the following day.
9. During the night, Code-a-mon and Trainers may heal, and Trainers may tame new monsters, except for the last 16 seconds of night in which it is declared too dangerous to go out.
10. Code-a-mon have stats: HP, MP, strength, magic, evasion, hit. They may gain exp and level up. Each stat determines how strong an attack will be and if they miss or not. Critical strikes occur only when a Code-a-mon hits an attacker with their weakness.
11. Code-a-mons' gain experience and may level up.
12. Battles occur only between two trainers at any given time.
13. In battle, there is only one entity attacking at a time in a turned base manner. When a Code-a-mon hit's zero, they may not be used in battle any longer, and can only heal if the trainer chooses to sleep at night. Experience points are earned based on the damage dealt but is not applied until the battle is over. Trainer's may attack or use Code-a-mon, there are no items.

II. SpotBugs Report

SpotBugs Report

Project Information

Project: ser316-summer2021-C-rmenese1-DP (spotbugsMain)

SpotBugs version: 4.0.0-beta4

Code analyzed:

- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/decorator/wildeland/Environment.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/decorator/wildeland/WildeLandDecorator.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/decorator/wildeland/Weather\$Night.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/decorator/wildeland/Weather\$Day.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/decorator/wildeland/Weather.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/decorator/wildeland/Weather\$Type.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/decorator/monster/Initial.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/decorator/monster/MonsterDecorator\$Type.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/decorator/monster/CodeAMon.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/decorator/monster/MonsterDecorator\$Skill.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/decorator/monster/MonsterDecorator.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/narrator/Narration.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/narrator/Narrator.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/narrator/narrative/DayZero.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/kampfarena/BattleMenu.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/kampfarena/Registration.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/kampfarena/Battle.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/kampfarena/Battle\$Move.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/kampfarena/Kampfarena.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/kampfarena/BattleMenu\$Option.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/singleton/Player.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/Main.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/mediator/colleague/Night.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/mediator/colleague/Day.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/mediator/WildeLandMediator.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/mediator/Mediator.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/factory/product/Monster.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/factory/product/AbstractTrainer.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/factory/product/AbstractMonster.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/factory/product/Trainer.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/factory/AbstractFactory.class
- /Users/Ryan/Desktop/SER\_316/ser316-summer2021-C-rmenese1-DP/build/classes/java/main/factory/Factory.class

Metrics

1475 lines of code analyzed, in 33 classes, in 11 packages.

Metric	Total	Density*
High Priority Warnings		0.00
Medium Priority Warnings		0.00
Total Warnings	0	0.00

(\* Defects per Thousand lines of non-commenting source statements)

### III. Checkstyle Report

#### CheckStyle Audit

Designed for use with [CheckStyle](#) and [Ant](#).

Summary	
Files	Errors
26	0

Files	
Name	Errors
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/Main.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/decorator/monster/CodeAMon.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/decorator/monster/Initial.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/decorator/monster/MonsterDecorator.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/decorator/wildeland/Environment.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/decorator/wildeland/Weather.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/decorator/wildeland/WildeLandDecorator.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/factory/AbstractFactory.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/factory/Factory.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/factory/product/AbstractMonster.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/factory/product/AbstractTrainer.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/factory/product/Monster.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/factory/product/Trainer.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/kampfarena/Battle.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/kampfarena/BattleMenu.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/kampfarena/Kampfarena.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/kampfarena/Registration.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/mediator/Mediator.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/mediator/WildeLandMediator.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/mediator/colleague/Day.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/mediator/colleague/Night.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/mediator/colleague/WildeLand.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/narrator/Narration.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/narrator/Narrator.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/narrator/narrative/DayZero.java</a>	0
<a href="#">/Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/singleton/Player.java</a>	0

File /Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/Main.java	
Error Description	Line
<a href="#">Back to top</a>	

File /Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/decorator/monster/CodeAMon.java	
Error Description	Line
<a href="#">Back to top</a>	

File /Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/decorator/monster/Initial.java	
Error Description	Line
<a href="#">Back to top</a>	

File /Users/Ryan/Desktop/SER_316/ser316-summer2021-C-rmenese1-DP/src/main/java/decorator/monster/MonsterDecorator.java	
Error Description	Line

## IV. JUnit Test Report

### Test Summary

<b>36</b> tests	<b>0</b> failures	<b>0</b> ignored	<b>3m37.02s</b> duration	<b>100%</b> successful
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#### Packages

#### Classes

Package	Tests	Failures	Ignored	Duration	Success rate
<a href="#">decorator</a>	11	0	0	0.355s	100%
<a href="#">kampfarena</a>	21	0	0	3m36.65s	100%
<a href="#">mediator</a>	1	0	0	0.008s	100%
<a href="#">singleton</a>	3	0	0	0.006s	100%

Generated by [Gradle 6.6.1](#) at Jun 28, 2021, 2:00:50 AM

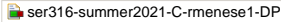

#### Note:

Due to the multithreaded environment of the program, testing was incredibly difficult. This is due to how the threads are synchronized which determines what can happen when based on the in-game clock and actions performed by the entities at random.





















A few of the tests, especially some in the Kampfarena package had to stay as general as possible. This is to encompass all the possible directions the program may go in.

For the most part the tests in the Mediator and Kampfarena packages, and those that depend on those packages, were designed in that fashion to focus more on testing the logic than any actual attribute values.

## V. Jacoco Test Report

### ser316-summer2021-C-rmenese1-DP

Element	Missed Instructions	Cov.	Missed Branches	Cov.	Missed	Cxty	Missed	Lines	Missed	Methods	Missed	Classes
default		0%		0%	31	31	146	146	8	8	1	1
kampfarena		83%		76%	19	91	48	282	1	37	0	6
factory.product		79%		80%	16	42	26	121	12	32	0	4
singleton		90%		78%	12	38	18	118	4	19	0	1
decorator.monster		93%		87%	5	58	9	185	2	33	0	4
mediator		90%		83%	5	29	9	68	2	14	0	1
decorator.wildeland		96%		78%	4	23	7	70	0	8	0	5
narrator.narrative		88%		90%	1	12	3	30	0	4	0	1
factory		100%	n/a	n/a	0	26	0	37	0	26	0	2
mediator.colleague		100%	n/a	n/a	0	10	0	20	0	10	0	3
narrator		100%		100%	0	4	0	10	0	3	0	1
Total	1,064 of 4,782	77%	95 of 305	68%	93	364	266	1,087	29	194	1	29

Created with [JaCoCo](#) 0.8.5.201910111838

Total instructions **including** Main in default: 4782

Coverage: 77%

Total instructions **excluding** Main in default: 4222

Coverage: 88%

**TravisCI:** <https://travis-ci.com/github/hiyaryan/ser316-summer2021-C-rmenese1-DP>

**GitHub:** <https://github.com/hiyaryan/ser316-summer2021-C-rmenese1-DP>