Exercises: Reflection

This document defines the exercises for "Java OOP Advanced" course @ Software University. Please submit your solutions (source code) of all below described problems in https://judge.softuni.bg/Contests/258/Reflection- Exercises.

Problem 1. Harvesting Fields

You are given a RichSoilLand class with lots of fields (look at the provided skeleton). Like the good farmer you are, you must harvest them. Harvesting means that you must print each **field** in a certain format (see output).

Input

You will receive a maximum of 100 lines with one of the following commands:

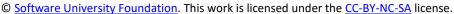
- private print all private fields
- protected print all protected fields
- public print all public fields
- all print ALL declared fields
- **HARVEST** end the input

Output

For each command you must print the **fields** that have the **given access modifier** as described in the input section. The format in which the fields should be printed is:

| Input | Output |
|---|--|
| protected HARVEST | protected String testString protected double aDouble protected byte testByte protected StringBuilder aBuffer protected BigInteger testBigNumber protected float testFloat protected Object testPredicate protected Object fatherMotherObject protected String moarString protected Exception inheritableException protected Stream moarStreamz |
| private public private HARVEST | private int testInt private long testLong private Calendar aCalendar private char testChar private BigInteger testBigInt private Thread aThread private Object aPredicate private Object hiddenObject private String anotherString private Exception internalException |





















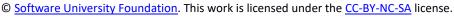
[&]quot;<access modifier> <field type> <field name>"

private Stream secretStream public double testDouble public String aString public StringBuilder aBuilder public short testShort public byte aByte public float aFloat public Thread testThread public Object anObject public int anotherIntBitesTheDust public Exception justException public Stream aStream private int testInt private long testLong private Calendar aCalendar private char testChar private BigInteger testBigInt private Thread aThread private Object aPredicate private Object hiddenObject private String anotherString private Exception internalException private Stream secretStream

all **HARVEST**

private int testInt public double testDouble protected String testString private long testLong protected double aDouble public String aString private Calendar aCalendar public StringBuilder aBuilder private char testChar public short testShort protected byte testByte public byte aByte protected StringBuilder aBuffer private BigInteger testBigInt protected BigInteger testBigNumber protected float testFloat public float aFloat private Thread aThread public Thread testThread private Object aPredicate protected Object testPredicate public Object anObject private Object hiddenObject protected Object fatherMotherObject private String anotherString protected String moarString public int anotherIntBitesTheDust private Exception internalException protected Exception inheritableException public Exception justException public Stream aStream protected Stream moarStreamz private Stream secretStream

















Problem 2. Black Box Integer

You are helping a buddy of yours who is still in the OOP Basics course - his name is Peshoslav (not to be mistaken with real people or trainers). He is rather slow and made a class with all private members. Your tasks are to instantiate an object from his class (always with start value 0) and then invoke the different methods it has. Your restriction is to not change anything in the class itself (consider it a black box). You can look at his class but don't touch anything! The class itself is called **BlackBoxInt**. It is a wrapper for the **int** primitive. The methods it has are:

```
private void add(int addend) {
    this.innerValue += addend;
}
private void subtract(int subtrahend) {
    this.innerValue -= subtrahend;
private void multiply(int multiplier) {
    this.innerValue *= multiplier;
private void divide(int divider) {
    this.innerValue /= divider;
private void leftShift(int shifter) {
    this.innerValue <<= shifter;
private void rightShift(int shifter) {
    this.innerValue >>= shifter;
```

Input

The input will consist of lines in the form:

<command name>_<value>

For instance: add_115

Input will always be valid and in the format described, so there is no need to check it explicitly. You stop receiving input when you encounter the command "END".

Output

Each command (except the END one) should print the current value of innerValue of the BlackBoxInt object you instantiated. **Don't cheat** by overriding to String in the class - you must get the value from the **private** field.

| Input | Output |
|-------------|--------|
| add_999999 | 999999 |
| subtract_19 | 999980 |
| divide_4 | 249995 |
| multiply_2 | 499990 |





















| rightShift_1 | 249995 |
|--------------|---------|
| leftShift_3 | 1999960 |
| END | |

Problem 3. BarracksWars - A New Factory

You are given a small console based project called Barracks (the code for it is included in the provided skeleton).

The general functionality the project has is adding new units to its repository and printing a report with statistics about the units currently in the repository. First let's go over the original task the project was made for:

Input

The input consists of commands each on a separate line. Commands that execute the functionality are:

- add <Archer/Swordsman/Pikeman/{...}> adds a unit to the repository.
- **report** prints a lexicological ordered statistic about the units in the repository.
- fight ends the input.

Output

Each command except **fight** should print output on the console.

- add should print: "<Archer/Swordsman/Pikeman/{...}> added!"
- report should print all the info in the repository in the format: "<UnitType> -> <UnitQuantity>", sorted by UnitType

Constraints

- Input will consist of no more than 1000 lines
- report command will never be given before any valid add command was provided

Your task

- 1) You have to study the code of the project and figure out how it works. However, there are parts of it that are not implemented (left with TODOs). You must implement the functionality of the createUnit method in the UnitFactoryImpl class so that it creates a unit based on the unit type received as parameter. Implement it in such a way that whenever you add a new unit it will be creatable without the need to change anything in the UnitFactoryImpl class (psst - use reflection). You can use the approach called Simple Factory.
- 2) Add two new unit classes (there will be tests that require them) Horseman with 50 health and 10 attack and Gunner with 20 health and 20 attack.

If you do everything correctly for this problem, you should write code only in the factories and units packages.

| Input | Output |
|---------------|------------------|
| add Swordsman | Swordsman added! |
| add Archer | Archer added! |
| add Pikeman | Pikeman added! |
| report | Archer -> 1 |
| add Pikeman | Pikeman -> 1 |

















| add Pikeman report fight | Swordsman -> 1 Pikeman added! Pikeman added! Archer -> 1 Pikeman -> 3 Swordsman -> 1 |
|--|--|
| add Pikeman add Pikeman add Gunner add Horseman add Archer add Gunner add Gunner add Horseman report fight | Pikeman added! Pikeman added! Gunner added! Horseman added! Archer added! Gunner added! Gunner added! Horseman added! Horseman added! Archer -> 1 Gunner -> 3 Horseman -> 2 Pikeman -> 2 |

Problem 4. * BarracksWars - The Commands Strike Back

As you might have noticed commands in the project from Problem 3 are implemented via a switch case with method calls in the Engine class. Although this approach works it is flawed when you add a new command because you have to add a new case for it. In some projects you might not have access to the engine and this would not work. Imagine this project will be outsourced and the outsourcing firm will not have access to the engine. Make it so whenever they want to add a new command they won't have to change anything in the Engine.

To do so employ the design pattern called **Command Pattern**. Here is how the base (abstract) command should look like:















```
public abstract class Command implements Executable {
    private String[] data;
    private Repository repository;
    private UnitFactory unitFactory;
    protected Command(String[] data,
                      Repository repository,
                      UnitFactory unitFactory) {
        this.data = data;
        this.repository = repository;
        this.unitFactory = unitFactory;
    protected Repository getRepository() {
        return repository;
    protected UnitFactory getUnitFactory() {
        return unitFactory;
    protected String[] getData() {
        return data;
}
```

Notice how all commands that extend this one will have both a Repository and a UnitFactory although not all of them need these. Leave it like this for this problem, because for the reflection to work we need all constructors to accept the same parameters. We will see how to go around this issue in problem 5.

Once you've implemented the pattern add a new command. It will have the following syntax:

- retire < UnitType> All it has to do is remove a unit of the provided type from the repository.
 - If there are no such units currently in the repository print: "No such units in repository."
 - If there is such a unit currently in the repository, print: "<UnitType> retired!"

To implement this command, you will also have to implement a corresponding method in the **UnitRepository**.

If you do everything correctly for this problem, you should write/refactor code only in the core and data packages.

| Input | Output |
|---------------|------------------------------|
| retire Archer | No such units in repository. |
| add Pikeman | Pikeman added! |
| add Pikeman | Pikeman added! |
| add Gunner | Gunner added! |
| add Horseman | Horseman added! |
| add Archer | Archer added! |

















add Gunner Gunner added! add Gunner Gunner added! Horseman added! add Horseman report Archer -> 1 retire Gunner Gunner -> 3 retire Archer Horseman -> 2 Pikeman -> 2 report retire Swordsman Gunner retired! retire Archer Archer retired! fight Archer -> 0 Gunner -> 3 Horseman -> 2 Pikeman -> 2 No such units in repository. No such units in repository.

Problem 5. * BarracksWars - Return of the Dependencies

In the final part of this epic problem trilogy we will resolve the issue where all Commands received all utility classes as parameters in their constructors. We can accomplish this by using an approach called dependency injection container. This approach is used in many frameworks like Spring for instance.

We will do a little twist on that approach. Remove all fields from the abstract command except the data. Instead put whatever fields each command needs in the concrete class. Create an annotation called Inject and make it so it can be used only on fields. Put the annotation over the fields we need to set trough reflection. Once you've prepared all of this, write the necessary reflection code in the Command Interpreter (which you should have refactored out from the engine in problem 4).

Use the tests from problem 4 to test your solution.



