Exercise 5

Inheritance and Polymorphism

Exercise 1 : Implement the following diagram.

```
        ┌─────────────────────────┐
        │       «interface»       │
        │        Soldier          │
        ├─────────────────────────┤
        │      public int hit()   │
        │ public boolean defend() │
        └─────────────────────────┘
                    △
                    │
        ┌─────────────────────────┐
        │      AbtractSoldier      │
        ├─────────────────────────┤
        │        life: int         │
        ├─────────────────────────┤
        └─────────────────────────┘
                    △
            ┌───────┴────────┐
    ┌───────────────┐  ┌───────────────┐
    │   Horsemen    │  │  Infantrymen  │
    ├───────────────┤  ├───────────────┤
    │               │  ├───────────────┤
    ├───────────────┤  └───────────────┘
    └───────────────┘
```
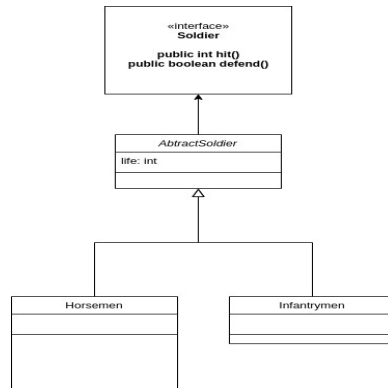
Decorator

The main idea of this exercise is to model soldier with war equipments and point of live. We have two categories of soldier, infantrymen and horsemen with some equipment for attack and defend.

We want to model some other categories of soldiers: Spearmen, Swordsmen, Archers, Crossbowmen, Knights and Albuquerque.

Spearmen: these types of infantry used spears most commonly combined with a medium shield and wearing the most minimal defense possible.

Swordsmen: armed with a sword, particularly the arming sword, paired with a medium shield and medium armor.

Archers: given a bow and light armor.

Crossbowmen: given a crossbow, a mail armor (medium), as well as a medium sized shield to protect them.

Knights: were mounted with a horse, held the arming sword, a mace, or a hand axe and wear plate armor (thick)

Arquebusiers: Wielding the arquebus rifle, and clad only in light types of armor paired with a short sword for close quarter combat

There are 3 types of equipment: armor (3 different types of armor-light, medium, and thick armor,), shield (3 different types of shields, light, medium and large,) and weapon (dagger, sword, a mace, or a hand axe, bow, crossbones, pike and rifle).

- If a soldier hits, method *int hit()* return the shot strength. This strength depends on the category of the equipment (sword, pike …) and the soldier strength. *hit()* takes no parameter.
- A soldier can defend the hit of a certain strength, method *boolean defend(int strength)* - the result is a Boolean which indicates if the soldier is already living or not. It depends on the equipment (shield …) and the category of the soldier.

Each solder and horse have a life (270 for men and 100 for horse) and a strength (2 for men and 6 for horse). Each equipment have a strength (for attack or defend) i.e. armor (light-2, medium-3, thick-4), shield (light-3, medium-4, thick-5) and weapons (dagger-3, sword-10, a mace-13, a hand axe-14, bow-4, crossbones-5, pike-5, rifle-7).

We are able to create pikemen with shields, swordmen with swords and shields . . . and to organize battles between them until they die.

Exercice 2

With the Decorator pattern:

1. Implement the method for the creation of these soldiers with these of the *defend* method and the *hit* method: Spearmen, Swordsmen, Archers, Crossbowmen, Knights (with sword, axe and mace correspondingly) and Arquebusiers.

2. Organize the battle between the following soldiers:
Spearmen vs the Swormen
Swordmen with a sword and a axe vs Knight

Archer vs Arquebusiers
Knights vs Archers.
Arquebusiers vs Swordmen
Spearmen with thick shield vs Swordmen with light armor.
Archers with thick armor vs Crossbowmen with no armor.
Arquebusiers with thick armor and thick Shield vs Knights with light armor
Knight with spear vs Knight with riffle and ligh armor.

Composite
We now want to create and to structure group of soldiers and so to be able to compose armies:
- An army can be composed by several soldiers groups
- Each group can hit or defend.
- The strength of the group is the total sum of the strength of the elements.
- For the defensive action, the strength of the shot is divided equally on each members.

Exercice 3
Using the Composite pattern:
Model the Battle of Stirling Bridge between England and Scotland with following info.
The kingdom of England: 9,000 men
~2,000 cavalry: 1500 Knight and 500 Knight with Axe
~7,000 infantry: 1000 Archers, 3000 Swordmen, 3000 Pikemen

The Kingdom of Scotland: 5,300 to 6,300 men
~300 cavalry: 200 Knight and 100 Knight with Mace
~6,000 infantry: 1500 Archers, 2000 Pikemen, 2000 Swordmen and 500 Swordmen with ace.