Exercises: Interfaces and Abstraction

This document defines the exercises for "Java OOP" course @ Software University. Please submit your solutions (source code) of all below described problems in Judge.

Problem 1. Define an Interface Person

Define an interface **Person** with methods **getName** and **getAge**. Define a class **Citizen** which implements **Person** and has a constructor which takes a **String name** and an **int age**.

Add the following code to your main method and submit it to Judge.

<<Interface>> Person
+ getName() : String + getAge() : int

Citizen
- name: String - age: int
+ Citizen (String, int) + getName() : String + getAge() : int

```
public static void main(String[] args) {
    Class[] citizenInterfaces = Citizen.class.getInterfaces();
    if(Arrays.asList(citizenInterfaces).contains(Person.class)){
        Method[] fields = Person.class.getDeclaredMethods();
        Scanner scanner = new Scanner(System.in);
        String name = scanner.nextLine();
        int age = Integer.parseInt(scanner.nextLine());
        Person person = new Citizen(name,age);
        System.out.println(fields.length);
        System.out.println(person.getName());
        System.out.println(person.getAge());
    }
}
```

If you defined the interface and implemented it correctly, the test should pass.

Examples

Input	Output
Pesho 25	2 Pesho 25

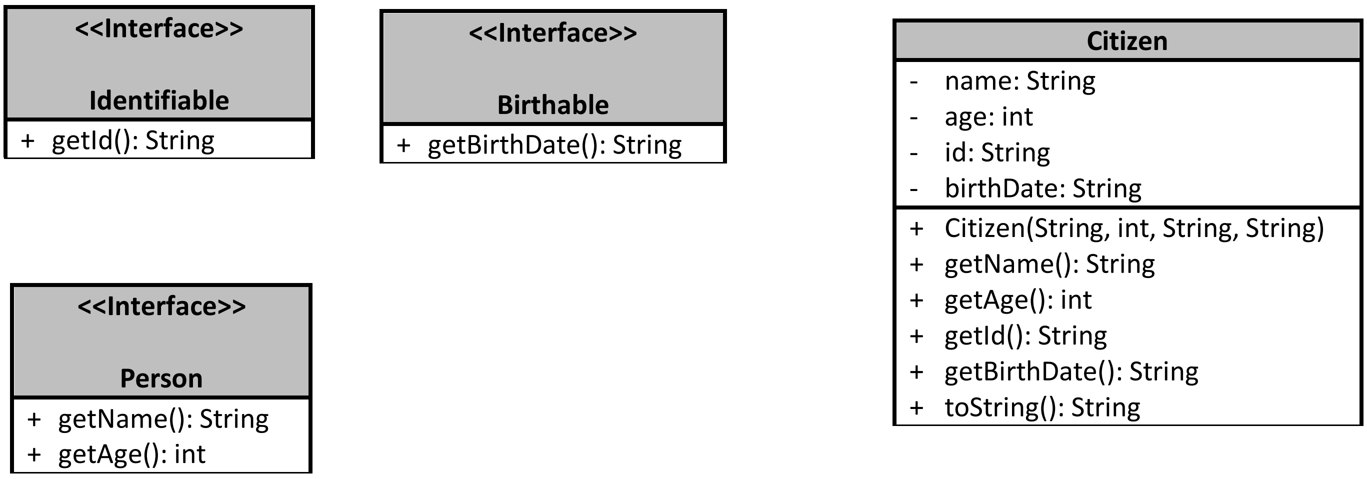
Problem 2. Multiple Implementation

Using the code from the previous task, define an interface **Identifiable** with a **String** method **getId** and an interface **Birthable** with a **String** method **getBirthDate** and implement them in the **Citizen** class. Rewrite the **Citizen** constructor to accept the new parameters.

Add the following code to your main method and submit it to Judge.

© Software University Foundation. This work is licensed under the CC-BY-NC-SA license.

Follow us:



```
public static void main(String[] args) {
    Class[] citizenInterfaces = Citizen.class.getInterfaces();
    if (Arrays.asList(citizenInterfaces).contains(Birthable.class)
            && Arrays.asList(citizenInterfaces).contains(Identifiable.class)) {
        Method[] methods = Birthable.class.getDeclaredMethods();
        methods = Identifiable.class.getDeclaredMethods();
        Scanner scanner = new Scanner(System.in);
        String name = scanner.nextLine();
        int age = Integer.parseInt(scanner.nextLine());
        String id = scanner.nextLine();
        String birthDate = scanner.nextLine();
        Identifiable identifiable = new Citizen(name,age,id,birthDate);
        Birthable birthable = new Citizen(name,age,id,birthDate);
        System.out.println(methods.length);
        System.out.println(methods[0].getReturnType().getSimpleName());
        System.out.println(methods.length);
        System.out.println(methods[0].getReturnType().getSimpleName());
    }
}
```

If you defined the interfaces and implemented them, the test should pass.

Examples

Input	Output
Pesho 25 9105152287 15/05/1991	1 String 1 String

Problem 3. Birthday Celebrations

It is a well known fact that people celebrate birthdays, it is also known that some people also celebrate their pets birthdays. Extend the program from your last task to add **birthdates** to citizens and include a class **Pet**, pets have a **name** and a **birthdate**. Also create class **Robot** which has an **id** and **model**. Encompass repeated functionality into interfaces and implement them in your classes.

You will receive from the console an unknown amount of lines until the command "**End**" is received, each line will contain information in one of the following formats **"Citizen <name> <age> <id> <birthdate>"** for citizens, "**Robot <model> <id>**" for robots or "**Pet <name> <birthdate>**" for pets. After the end command on the next line

© Software University Foundation. This work is licensed under the CC-BY-NC-SA license.
Follow us:

you will receive a single number representing **a specific year**, your task is to print all birthdates (of both citizens and pets) in that year in the format **day/month/year** (the order of printing doesn't matter).

<<Interface>> **Identifiable**
+ getId(): String

<<Interface>> **Birthable**
+ getBirthDate(): String

Citizen
- name: String - age: int - id: String - birthDate: String
+ Citizen(Stirng, int, String, String) + getName(): String + getAge(): int + getId(): String

Robot
- id: String - model: String
+ Robot(Stirng, String) + getId(): String + getModel(): String

Pet
- name: String - birthDate: String
+ Pet(Stirng, String) + getName(): String + getBirthDate(): String

Examples

Input	**Output**

`Citizen Pesho 22 9010101122 10/10/1990`
`Pet Sharo 13/11/2005`
`Robot MK-13 558833251`
`End`
`1990`
	`10/10/1990`

`Citizen Stamat 16 0041018380 01/01/2000`
`Robot MK-10 12345678`
`Robot PP-09 00000001`
`Pet Topcho 24/12/2000`
`Pet Kosmat 12/06/2002`
`End`
`2000`
	`01/01/2000`
	`24/12/2000`

`Robot VV-XYZ 11213141`
`Citizen Penka 35 7903210713 21/03/1979`
`Citizen Kane 40 7409073566 07/09/1974`
`End`
`1975`
	`<no output>`

Problem 4. Food Shortage

Your totalitarian dystopian society suffers a shortage of food, so many rebels appear. Extend the code from your previous (Problem 2.**Multiple Implementation**) task with new functionality to solve this task.

Define a class **`Rebel`** which has a **name**, **age** and **group** (String)**,** names are **unique -** there will never be 2 Rebels/Citizens or a Rebel and Citizen with the same name**.** Define an interface **Buyer** which defines a methods **buyFood()** and a **getFood()**. Implement the **Buyer** interface in the **Citizen** and **Rebel** class, both Rebels and Citizens **start with 0 food**, when a Rebel buys food his **food** increases by **5**, when a Citizen buys food his **food** increases by **10**.

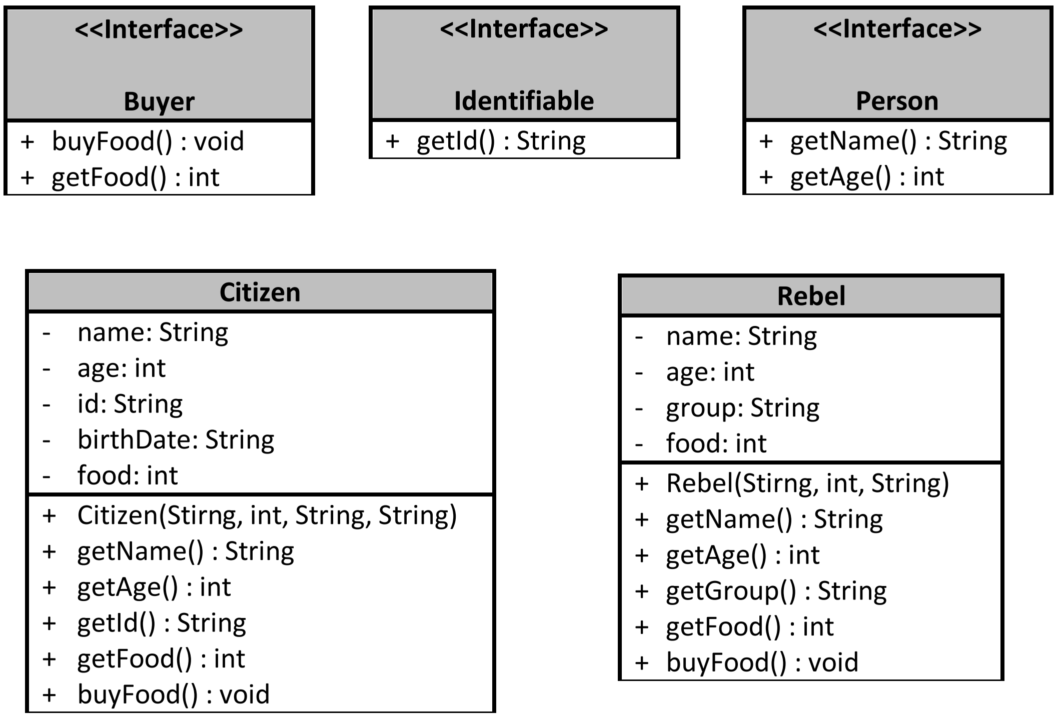
© Software University Foundation. This work is licensed under the CC-BY-NC-SA license.

SoftUni Foundation

Follow us:

On the first line of the input you will receive an integer **N** - the number of people, on each of the next **N** lines you will receive information in one of the following formats "**<name> <age> <id> <birthdate>**" for a Citizen or "**<name> <age><group>**" for a Rebel. After the **N** lines until the command "**End**" is received, you will receive names of people who bought food, each on a new line. Note that not all names may be valid, in case of an incorrect name - nothing should happen.

On the only line of output, you should print the total amount of food purchased.



Examples

Input	Output

`2`
`Pesho 25 8904041303 04/04/1989`
`Stancho 27 WildMonkeys`
`Pesho`
`Gosho`
`Pesho`
`End`
	`20`

`4`
`Stamat 23 TheSwarm`
`Toncho 44 7308185527 18/08/1973`
`Joro 31 Terrorists`
`Penka 27 881222212 22/12/1988`
`Jiraf`
`Joro`
`Jiraf`
`Joro`
`Stamat`
`Penka`
`End`
	`25`

© Software University Foundation. This work is licensed under the CC-BY-NC-SA license.

Follow us:

Problem 5. Telephony

You have a business - **manufacturing cell phones**. But you have no software developers, so you call your friends and ask them to help you create a cell phone software. They agree and you start working on the project. The project consists of one main **model - a Smartphone**. Each of your smartphones should have functionalities of **calling other phones** and **browsing in the world wide web.**

Your friends are very busy, so you decide to write the code on your own. Here is the mandatory assignment:

You should have a **model** - **Smartphone** and two separate functionalities which your smartphone has - to **call other phones** and to **browse in the world wide web**. You should end up with **one class** and **two interfaces**.

<<Interface>> **Callable**
+ call(): String

<<Interface>> **Browsable**
+ browse(): String

Smartphone
- numbers: List<String> - urls: List<String>
+ Smartphone(List<String>, List<String>) + call(): String + browse(): String

Input

The input comes from the console. It will hold two lines:

- **First line**: **phone numbers** to call (String), separated by spaces.
- **Second line: sites** to visit (String), separated by spaces.

Output

- First **call all numbers** in the order of input then **browse all sites** in order of input
- The functionality of calling phones is printing on the console the number which are being called in the format: **`"Calling... <number>"`**
- The functionality of the browser should print on the console the site in format: **`"Browsing: <site>!"`** (pay attention to the exclamation mark when printing URLs)
- If there is a number in the input of the URLs, print: **"Invalid URL!"** and continue printing the rest of the URLs.
- If there is a character different from a digit in a number, print: **"Invalid number!"** and continue to the next number.

Constraints

- Each site's URL should consist only of letters and symbols (**No digits are allowed** in the URL address)

Examples

Input	Output

`0882134215 0882134333 08992134215 0558123 3333 1`
`http://softuni.bg http://youtube.com http://www.g00gle.com`
	`Calling... 0882134215`
	`Calling... 0882134333`
	`Calling... 08992134215`
	`Calling... 0558123`
	`Calling... 3333`
	`Calling... 1`
	`Browsing: http://softuni.bg!`
	`Browsing: http://youtube.com!`
	`Invalid URL!`

© Software University Foundation. This work is licensed under the CC-BY-NC-SA license.

SoftUni Foundation

Follow us:

Problem 6. *Military Elite

Create the following class hierarchy:

- **SoldierImpl** – general class for soldiers, holding **id** (int), **first name** and **last name**
    - **PrivateImpl** – lowest base soldier type, holding the field **salary**(double)
        - **LieutenantGeneralImpl** – holds a set of **PrivatesImpl** under his command
            - **public void addPrivate(Private priv)**
        - **SpecialisedSoldierImpl –** general class for all specialised soldiers – holds the **corps** of the soldier. The corps can only be one of the following: **"Airforces"** or **"Marines"** (Enumeration)
            - **EngineerImpl** – holds a set of **repairs**. A **repair** holds a **part name** and **hours worked** (int)
                - **public void addRepair(Repair repair)**
                - **public Collection<Repair> getRepairs()**
            - **CommandoImpl** – holds a set of **missions**. A mission holds **code name** and a **state** (Enumeration: **"inProgress"** or **"finished"**). A mission can be finished through the method **completeMission()**
                - **public void addMission(Mission mission)**
                - **public Collection<Mission> getMissions()**
    - **SpyImpl** – holds the **code number** of the spy.

Extract **interfaces** for each class. (e.g. **Soldier**, **Private**, **LieutenantGeneral**, etc.) The interfaces should hold their public get methods (e.g. **Soldier** should hold **getId**, **getFirstName** and **getLastName**). Each class should implement its respective interface. Validate the input where necessary (corps, mission state) - input should match **exactly** one of the required values, otherwise it should be treated as **invalid**. In case of **invalid corps** the entire line should be skipped, in case of an **invalid mission state** only the mission should be skipped.

You will receive from the console an unknown amount of lines containing information about soldiers until the command "**End**" is received. The information will be in one of the following formats:

- Private: "**Private <id> <firstName> <lastName> <salary>**"
- LieutenantGeneral: "**LieutenantGeneral <id> <firstName> <lastName> <salary> <private1Id> <private2Id> … <privateNId>**" where privateXId will **always** be an **Id** of a private already received through the input
- Engineer: "**Engineer <id> <firstName> <lastName> <salary> <corps> <repair1Part> <repair1Hours> … <repairNPart> <repairNHours>**" where repairXPart is the name of a repaired part and repairXHours the hours it took to repair it (the two parameters will always come paired)
- Commando: "**Commando <id> <firstName> <lastName> <salary> <corps> <mission1CodeName> <mission1state> … <missionNCodeName> <missionNstate>**" a missions code name, description and state will always come together
- Spy: "**Spy <id> <firstName> <lastName> <codeNumber>**"

Define proper constructors. Avoid code duplication through abstraction. Override **toString()** in all classes to print detailed information about the object.

Privates:
"Name: <firstName> <lastName> Id: <id> Salary: <salary>"

Spy:
**"Name: <firstName> <lastName> Id: <id>
Code Number: <codeNumber>"**

© Software University Foundation. This work is licensed under the CC-BY-NC-SA license.
Follow us:

LieutenantGeneral:
"Name: <firstName> <lastName> Id: <id> Salary: <salary>
Privates:
  <private1 ToString()>
  <private2 ToString()>
  …
  <privateN ToString()>"

Note: privates must be sorted by id in **descending order**.

Engineer:
"Name: <firstName> <lastName> Id: <id> Salary: <salary>
Corps: <corps>
Repairs:
  <repair1 ToString()>
  <repair2 ToString()>
  …
  <repairN ToString()>"

Commando:
"Name: <firstName> <lastName> Id: <id> Salary: <salary>
Corps: <corps>
Missions:
  <mission1 ToString()>
  <mission2 ToString()>
  …
  <missionN ToString()>"

Repair:
"Part Name: <partName> Hours Worked: <hoursWorked>"

Mission:
"Code Name: <codeName> State: <state>"

NOTE: Salary should be printed rounded to **two decimal places** after the separator.

Examples

Input	Output

```
Private 1 Pesho Peshev 22.22
Commando 13 Stamat Stamov 13.1 Airforces
Private 222 Toncho Tonchev 80.08
LieutenantGeneral 3 Joro Jorev 100 222 1
End
```
	```
	Name: Pesho Peshev Id: 1 Salary: 22.22
	Name: Stamat Stamov Id: 13 Salary: 13.10
	Corps: Airforces
	Missions:
	Name: Toncho Tonchev Id: 222 Salary: 80.08
	Name: Joro Jorev Id: 3 Salary: 100.00
	Privates:
	  Name: Toncho Tonchev Id: 222 Salary: 80.08
	  Name: Pesho Peshev Id: 1 Salary: 22.22
	```

```
Engineer 7 Pencho Penchev 12.23 Marines Boat
2 Crane 17
Commando 19 Penka Ivanova 150.15 Airforces
HairyFoot Finished Freedom inProgress
```
	```
	Name: Pencho Penchev Id: 7 Salary: 12.23
	Corps: Marines
	Repairs:
	  Part Name: Boat Hours Worked: 2
	```

SoftUni Foundation
© Software University Foundation. This work is licensed under the CC-BY-NC-SA license.
Follow us:

`End`	`  Part Name: Crane Hours Worked: 17`
	`Name: Penka Ivanova Id: 19 Salary: 150.15`
	`Corps: Airforces`
	`Missions:`
	`  Code Name: Freedom State: inProgress`

`LieutenantGeneral 17 No Units 500.01`
`Spy 7 James Bond 007`
`Spy 8 James Boned 008`
`End`
	`Name: No Units Id: 17 Salary: 500.01`
	`Privates:`
	`Name: James Bond Id: 7`
	`Code Number: 007`
	`Name: James Boned Id: 8`
	`Code Number: 008`

Problem 7. *Collection Hierarchy

Create 3 different string collections – **AddCollection**, **AddRemoveCollection** and **MyListImpl**.

The **AddCollection** should have:

- Only a single method **add(String)** which adds an item to the **end** of the collection.

The **AddRemoveCollection** should have:

- An **add(String)** method – which adds an item to the **start** of the collection.
- A **remove()** method which removes the **last** item in the collection.

The **MyListImpl** collection should have:

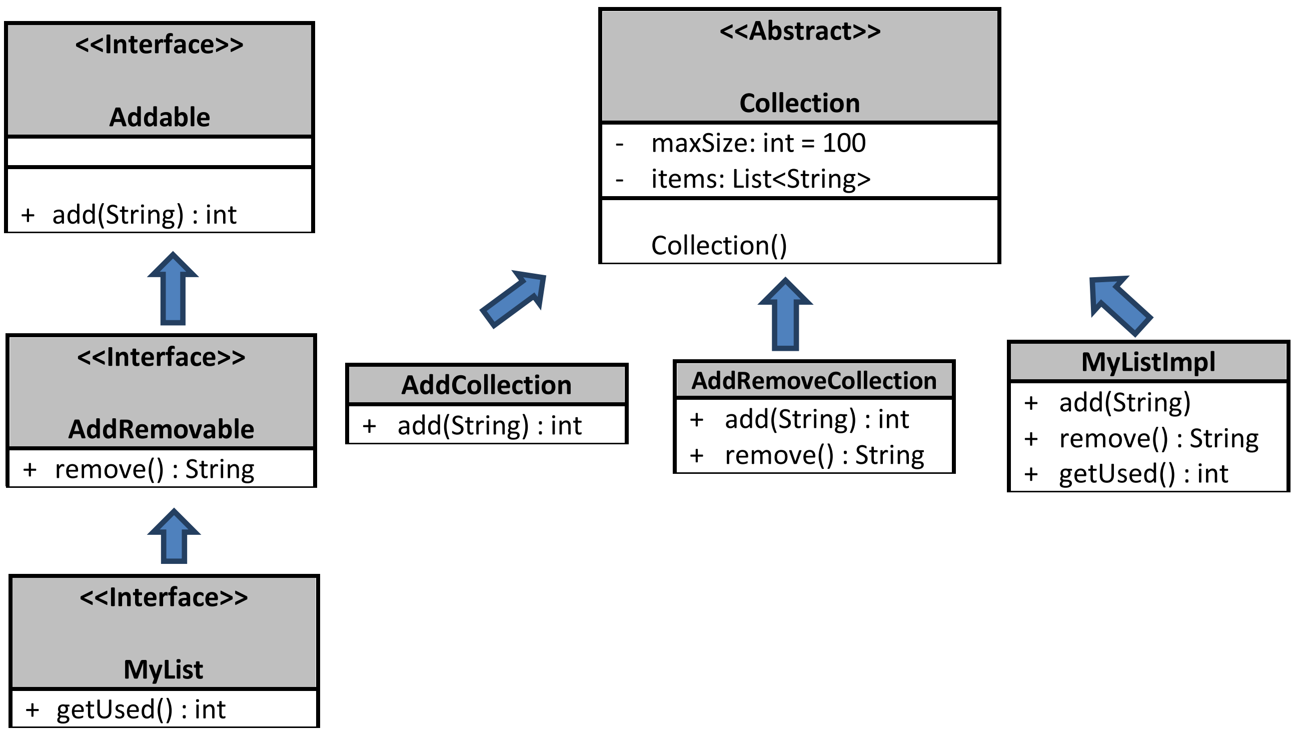
- An **add(String)** method which adds an item to the **start** of the collection.
- A **remove()** method which removes the **first** element in the collection.
- A **used** field which displays the size of elements currently in the collection.

Create interfaces which define the collections functionality, think how to model the relations between interfaces to reuse code. Add an extra bit of functionality to the methods in the custom collections, **add** methods should return the index in which the item was added, **remove** methods should return the item that was removed.

Your task is to create a single copy of your collections, after which on the first input line you will receive a random amount of strings in a single line separated by spaces - the elements you have to add to each of your collections. For each of your collections write a single line in the output that holds the results of all **add operations** separated by spaces (check the examples to better understand the format). On the second input line you will receive a single number - the amount of **remove operations** you have to call on each collection. In the same manner as with the **add** operations for each collection (except the AddCollection), print a line with the results of each **remove** operation separated by spaces.

© Software University Foundation. This work is licensed under the CC-BY-NC-SA license.

Follow us:



Input

The input comes from the console. It will hold two lines:

- The first line will contain a random amount of strings separated by spaces - the elements you have to **add** to each of your collections.
- The second line will contain a single number - the amount of **remove** operations.

Output

The output will consist of 5 lines:

- The first line contains the results of all **add** operations on the **AddCollection** separated by spaces.
- The second line contains the results of all **add** operations on the **AddRemoveCollection** separated by spaces.
- The third line contains the result of all **add** operations on the **MyListImpl** collection separated by spaces.
- The fourth line contains the result of all **remove** operations on the **AddRemoveCollection** separated by spaces.
- The fifth line contains the result of all **remove** operations on the **MyListImpl** collection separated by spaces.

Constraints

- All collections should have a **length of 100.**
- There will never be **more than 100** add operations.
- The number of remove operations will never be more than the amount of add operations.

Examples

Input	Output

`apple orange peach`
`3`
	`0 1 2`
	`0 0 0`
	`0 0 0`
	`apple orange peach`

© Software University Foundation. This work is licensed under the CC-BY-NC-SA license.
SoftUni Foundation
Follow us:

	`peach orange apple`

`one two three four five six seven`
`4`
	`0 1 2 3 4 5 6`
	`0 0 0 0 0 0 0`
	`0 0 0 0 0 0 0`
	`one two three four`
	`seven six five four`

Hint

Create an interface hierarchy representing the collections. You can use a List as the underlying collection and implement the methods using the List's add, remove and insert methods.

SoftUni Foundation
© Software University Foundation. This work is licensed under the CC-BY-NC-SA license.
Follow us: