# Exercises: Encapsulation

This document defines the exercises for ["Java OOP" course @ Software University](https://softuni.bg/trainings/2245/java-oop-february-2019). Please submit your solutions (source code) of all below described problems in <https://judge.softuni.bg/Contests/1536/Encapsulation-Exercises> .

## Class Box

|  |  |
| --- | --- |
| **Box** | |
| - | length: double |
| - | width: double |
| - | height: double |
| + | Box( double , double , double ) |
| + | calculateSurfaceArea (): double |
| + | calculateLateralSurfaceArea (): double |
| + | calculateVolume (): double |

You are given a geometric figure box with parameters **length**, **width** and **height**. Model a class **Box** that that can be instantiated by the same three parameters. Expose to the outside world only methods for its surface area, lateral surface area and its volume (formulas: <http://www.mathwords.com/r/rectangular_parallelepiped.htm>).

On the first three lines you will get the length, width and height. On the next three lines print the **surface area**, **lateral surface area** and the **volume** of the box:

### Examples

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| --- | --- |
| **Input** | **Output** |
| 2  3  4 | Surface Area - 52.00  Lateral Surface Area - 40.00  Volume – 24.00 |
| 1.3  1  6 | Surface Area - 30.20  Lateral Surface Area - 27.60  Volume - 7.80 |

|  |  |
| --- | --- |
| **Box** | |
| - | length: double |
| - | width: double |
| - | height: double |
| + | Box (double , double , double) |
| - | setLength(double): void |
| - | setWidth(double): void |
| - | setHeight(double): void |
| + | calculateSurfaceArea (): double |
| + | calculateLateralSurfaceArea (): double |
| + | calculateVolume (): double |

## Class Box Data Validation

A box’s side **should not** be zero or a negative number. Expand your class from the previous problem by adding data validation for each parameter given to the constructor. Make a private setter that performs **data validation internally**.

### Examples

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| --- | --- |
| **Input** | **Output** |
| 2  -3  4 | Width cannot be zero or negative. |

## Animal Farm

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| --- | --- |
| **Chicken** | |
| - | name: String |
| - | age: int |
| + | Chicken ( String , int ) |
| - | setName (String) : void |
| - | setAge (int): void |
| + | productPerDay (): double |
| - | calculateProductPerDay() : double |

You should be familiar with encapsulation already. For this problem, you’ll need to create class called **Chicken**. Chicken should

contains several **fields**, a **constructor**, several **properties** and several **methods**. Your task is to encapsulate or hide anything that is not intended to be viewed or modified from outside the class.

Chicken lives for **15 years**. Chicken have **name** for sure, at least **1 symbol** long. Chicken producing eggs:

* First 6 years it produces 2 eggs per day [0 - 5]
* Next 6 years it produces 1 egg per day [6 - 11]
* And after that it produces 0.75 eggs per day

### Step 1. Encapsulate Fields

Fields should be **private**. Leaving fields open for modification from outside the class is potentially dangerous. Make all fields in the Chicken class private.

In case the value inside a field is needed elsewhere, use **getters** to reveal it.

### Step 2. Ensure Classes Have a Correct State

Having **getters and setters** is useless if you don’t actually use them. The Chicken constructor modifies the fields directly which is wrong when there are suitable setters available. Modify the constructor to fix this issue.

### Step 3. Validate Data Properly

Validate the chicken’s **name** (it cannot be null, empty or whitespace). In case of **invalid name**, print exception message "Name cannot be empty."

Validate the **age** properly, minimum and maximum age are provided, make use of them. In case of **invalid age**, print exception message "Age should be between 0 and 15."

### Step 4. Hide Internal Logic

If a method is intended to be used only by descendant classes or internally to perform some action, there is no point in keeping them **public**. The **calculateProductPerDay()** method is used by the **productPerDay()** public getter. This means the method can safely be hidden inside the Chicken class by declaring it **private**.

### Step 4. Submit Code to Judge

Submit your code as a **zip file** in Judge. Make sure you have a **public Main class** with a **public static void main** method in it.

### Examples

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| --- | --- |
| **Input** | **Output** |
| Mara  10 | Chicken Mara (age 10) can produce 1 eggs per day. |
| Mara  17 | Age should be between 0 and 15. |
| Gosho  6 | Chicken Gosho (age 6) can produce 1 eggs per day. |

## Shopping Spree

Create two classes: class **Person** and class **Product**. Each person should have

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| --- | --- |
| **Person** | |
| - | name: String |
| - | money: double |
| - | products: List<Product> |
| + | Person (String , double) |
| - | setName (String) : void |
| - | setMoney (double) : void |
| + | buyProduct (Product) : void |

a **name**, **money** and a **bag of products**. Each product should have **name** and **cost**. Name cannot be an empty string. Be careful about **white space** in name. Money cannot be a negative number.

Create a program in which each command corresponds to a person buying a product. If the person **can afford** a product **add it** to his bag. If a person **doesn’t have** enough money, **print** an appropriate message ("[Person name] can't afford [Product name]").

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| --- | --- |
| **Product** | |
| - | name: String |
| - | cost: double |
| + | Product (String, double) |
| - | setCost (double) : void |
| - | setName (String) : void |
| + | getCost () : double |

On the first two lines you are given all people and all products. After all purchases print every person in the order of appearance and all products that he has bought also in order of appearance. If nothing is bought, print

the name of the person followed by "Nothing bought".

Read commands till you find line with **"END"** command. In case of invalid input (negative money exception message: "**Money cannot be negative**") or empty name: (empty name exception message "**Name cannot be empty**") break the program with an appropriate message. See the examples below:

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| Pesho=11;Gosho=4  Bread=10;Milk=2  Pesho Bread  Gosho Milk  Gosho Milk  Pesho Milk  END | Pesho bought Bread  Gosho bought Milk  Gosho bought Milk  Pesho can't afford Milk  Pesho - Bread  Gosho - Milk, Milk |
| Mimi=0  Kafence=2  Mimi Kafence  END | Mimi can't afford Kafence  Mimi – Nothing bought |
| Jeko=-3  Chushki=1  Jeko Chushki  END | Money cannot be negative |

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| --- | --- |
| **Pizza** | |
| - | name: String |
| - | dought: Dough |
| - | toppings: List<Topping> |
| + | Piza (String, int) |
| - | setToppings(int) : void |
| - | setName(String) : void |
| + | setDough(Dough) : void |
| + | addTopping (Topping) : void |
| + | getOverallCalories () : double |

## Problem 5. \*Pizza Calories

A Pizza is made of a dough and different toppings.

You should model a class **Pizza** which should have a **name**, **dough** and

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| --- | --- |
| **Topping** | |
| - | toppingType: String |
| - | weight: double |
| + | Topping (String, double) |
| - | setToppingType (String) : void |
| - | setWeight (double) : void |
| + | calculateCalories () : double |

**toppings** as fields. Every type of ingredient should have its own class.

Every ingredient has **different properties**: the dough can be **white** or **wholegrain** and in addition it can be **crispy**, **chewy** or **homemade**. The toppings can be of type **meat**, **veggies**, **cheese** or **sauce**.

Every ingredient should have a **weight** in grams and a method for

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| --- | --- |
| **Dough** | |
| - | flourType : String |
| - | bakingTechnique : String |
| - | weight: double |
| + | Dought (String, String, double) |
| - | setWeight(double) : void |
| - | setFlourType(String) : void |
| - | setBakingTechnique(String) : void |
| + | calculateCalories () : double |

calculating its calories according its type. Calories per gram are calculated through modifiers. Every ingredient has **2 calories per gram** **as a base** and a **modifier** that gives the exact calories.

**Your job** is to model the classes in such a way that they are **properly encapsulated** and to provide a public method for every pizza that **calculates its calories according to the ingredients it has**.

|  |  |
| --- | --- |
| **Dough Modifiers** | **Toppings Modifiers** |
|  |  |
| * White – 1.5; * Wholegrain – 1.0; * Crispy – 0.9; * Chewy – 1.1; * Homemade – 1.0; | * Meat – 1.2; * Veggies – 0.8; * Cheese – 1.1; * Sauce – 0.9; |

For example, **white** dough has a modifier of **1.5**, a **chewy** dough has a modifier of **1.1**, which means that a white chewy dough weighting **100 grams** will have (2 \* 100) \* 1.5 \* 1.1 = **330.00 total calories**.

For example, **meat** has a modifier of **1.2**, which means that a meat weighting **50 grams** will have (2 \* 50) \* 1.2 = 120.00 total calories.

### Data Validation

**Data Validation must be in the order of the Input Data.**

* If invalid flour type or an invalid baking technique is given an exception is thrown with the message "**Invalid type of dough.**".
* If dough weight is outside of range [1..200] throw an exception with the message "**Dough weight should be in the range [1..200]**."
* If topping is not one of the provided types throw an exception with the message "**Cannot place [name of invalid argument] on top of your pizza.**"
* If topping weight is outside of range [1..50] throw an exception with the message "[**Topping type name] weight should be in the range [1..50].**".
* If name of the pizza is empty or longer than 15 symbols throw an exception with the message "**Pizza name should be between 1 and 15 symbols.**".
* If number of topping is outside of range [0..10] throw an exception with the message "**Number of toppings should be in range [0..10].**".

The input for a pizza consists of several lines:

* On the first line is the **pizza name** and the **number of toppings it has** in format:
  + Pizza {**pizzaName**} {**numberOfToppings**}
* On the second line you will get input for the **dough** in format:
  + Dough {**flourType**} {**bakingTechnique**} {**weightInGrams**}
* On the next **N** lines, you will receive every topping the pizza has, where **N** is **number of lines for the toppings**:
  + Topping {**toppingType**} {**weightInGrams**}

If creation of the pizza was **successful** print on a single line the name of the pizza and the **total calories** it has, rounded to the second digit after the decimal point.

### Examples

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| --- | --- |
| **Input** | **Output** |
| Pizza Meatless 2  Dough Wholegrain Crispy 100  Topping Veggies 50  Topping Cheese 50  END | Meatless – 370.00 |
| Pizza Bulgarian 20  Dough Tip500 Balgarsko 100  Topping Sirene 50  Topping Cheese 50  Topping Krenvirsh 20  Topping Meat 10  END | Number of toppings should be in range [0..10]. |
| Pizza Bulgarian 2  Dough Tip500 Balgarsko 100  Topping Sirene 50  Topping Cheese 50  Topping Krenvirsh 20  Topping Meat 10  END | Invalid type of dough. |
| Pizza Bulgarian 2  Dough White Chewy 100  Topping Sirene 50  Topping Cheese 50  Topping Krenvirsh 20  Topping Meat 10  END | Cannot place Sirene on top of your pizza. |

|  |  |
| --- | --- |
| **Team** | |
| - | name: String |
| - | players: List<Player> |
| + | Team (String) |
| - | setName(String) : void |
| + | addPlayer(Player) : void |
| + | removePlayer(String) : void |
| + | getRating() : double |

## Problem 6. \*\*Football Team Generator

A football team has variable number of players, a name and a rating.

A **player** has a **name** and **stats** which are the basis for his skill level. The stats a player has are **endurance**, **sprint**, **dribble**, **passing** and **shooting**. Each stat can be in the range [0..100]. The **overall skil**l level of a player is

|  |  |
| --- | --- |
| **Player** | |
| - | name: String |
| - | endurance: int |
| - | sprint: int |
| - | dribble: int |
| - | passing: int |
| - | shooting: int |
| + | Player (String, int, int, int, int, int) |
| - | setName(String) : void |
| - | setEndurance (int) : void |
| - | setSprint (int) : void |
| - | setDribble (int) : void |
| - | setPassing (int) : void |
| - | setShooting (int) : void |
| + | overallSkillLevel() : double |

calculated as the **average** of his stats. Only the name of a player and his stats should be visible to all of the outside world. Everything else should be hidden.

A **team** should expose a **name**, a **rating** (calculated by the average skill level of all players in the team) and **methods** for adding and removing players.

Your task is to model the team and the players following the proper principles of Encapsulation. Expose only the properties that needs to be visible and validate data appropriately.

### Input

Your application will receive commands until the "**END**" command is given. The command can be one of the following:

* **"Team;<TeamName>"** – add a new team;
* **"Add;<TeamName>;<PlayerName>;<Endurance>;<Sprint>;<Dribble>;<Passing>;<Shooting>"** – add a new player to the team;
* **"Remove;<TeamName>;<PlayerName>"** –remove the player from the team;
* **"Rating;<TeamName>"** – print the team rating, rounded to a closest integer.

### Data Validation

* A **name** cannot be null, empty or white space. If not, print "**A name should not be empty.** "
* **Stats** should be in the range 0..100. If not, print "**[Stat name] should be between 0 and 100.** "
* If you receive a command to **remove** a missing player, print "**Player [Player name] is not in [Team name] team.** "
* If you receive a command to **add** a player to a missing team, print "**Team [team name] does not exist.**"
* If you receive a command to **show** stats for a missing team, print "**Team [team name] does not exist.**"

### Examples

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| --- | --- |
| **Input** | **Output** |
| Team;Arsenal  Add;Arsenal;Kieran\_Gibbs;75;85;84;92;67  Add;Arsenal;Aaron\_Ramsey;95;82;82;89;68  Remove;Arsenal;Aaron\_Ramsey  Rating;Arsenal  END | Arsenal – 81 |
| Team;Arsenal  Add;Arsenal;Kieran\_Gibbs;75;85;84;92;67  Add;Arsenal;Aaron\_Ramsey;195;82;82;89;68  Remove;Arsenal;Aaron\_Ramsey  Rating;Arsenal  END | Endurance should be between 0 and 100.  Player Aaron\_Ramsey is not in Arsenal team.  Arsenal - 81 |
| Team;Arsenal  Rating;Arsenal  END | Arsenal – 0 |