# Exercises: Defining Classes

Problems for exercises and homework for the ["C# Advanced" course @ Software University](https://softuni.bg/courses/csharp-advanced).  
You can check your solutions here: <https://judge.softuni.bg/Contests/1479/Defining-Classes-Exercise>

## Define a Class Person

**NOTE**: You need a StartUp class with the namespace DefiningClasses.

Define a class **Person** with **private** fields for **name** and **age** and **public** properties **Name** and **Age**.

### Bonus\*

Try to create a few objects of type Person:

|  |  |
| --- | --- |
| **Name** | **Age** |
| Pesho | 20 |
| Gosho | 18 |
| Stamat | 43 |

Use both the inline initialization and the default constructor.

## Creating Constructors

**NOTE**: You need a StartUp class with the namespace DefiningClasses.

Add **3** constructors to the **Person** class from the last task. Use constructor chaining to reuse code:

* The **first** should take **no arguments** and produce a person with name "**No name**" and **age** **= 1**.
* The **second** should accept only an integer **number** for the **age** and produce a person with name "**No name**" and **age** equal to the passed **parameter**.
* The **third** one should accept a **string** for the **name** and an integer for the **age** and should produce a person with the given **name** and **age**.

## Oldest Family Member

Use your **Person** **class** from the previous tasks. Create a class **Family**. The class should have a **list of people**, a method for adding members - **void AddMember(Person member)** and a method returning the oldest family member– **Person GetOldestMember()**. Write a program that reads the names and ages of **N** people and **adds them to the family**. Then **print** the **name** and **age** of the oldest member.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 3  Pesho 3  Gosho 4  Annie 5 | Annie 5 |
| 5  Steve 10  Christopher 15  Annie 4  Ivan 35  Maria 34 | Ivan 35 |

## Opinion Poll

Using the **Person** class, write a program that reads from the console **N** lines of personal information and then prints all people, whose **age** is **more than 30** years, **sorted in alphabetical order**.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 3  Pesho 12  Stamat 31  Ivan 48 | Ivan - 48  Stamat - 31 |
| 5  Nikolai 33  Yordan 88  Tosho 22  Lyubo 44  Stanislav 11 | Lyubo - 44  Nikolai - 33  Yordan - 88 |

## Date Modifier

Create a class **DateModifier**, which stores the difference of the days between two dates. It should have a method which takes **two string parameters** **representing a date** as strings and **calculates** thedifference in the days between them.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 1992 05 31  2016 06 17 | 8783 |
| 2016 05 31  2016 04 19 | 42 |

## Company Roster

Define a class **Employee** that holds the following information: **name, salary, position, department, email** and **age**. The **name, salary**, **position** and **department** are **mandatory** while the rest are **optional**.

Your task is to write a program, which takes **N** lines of employees from the console and **calculates** the **department** with the **highest** **average** **salary** and **prints** for each employee in that department his **name, salary, email and age** – **sorted by salary in descending order**. If an employee **doesn’t have** an **email** – print "**n/a**" instead, if he doesn’t have an **age** – print "**-1**" instead. The **salary** should be print formated **two digits** after the decimal seperator.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 4  Pesho 120.00 Dev Development pesho@abv.bg 28  Toncho 333.33 Manager Marketing 33  Ivan 840.20 ProjectLeader Development ivan@ivan.com  Gosho 0.20 Freeloader Nowhere 18 | Highest Average Salary: Development  Ivan 840.20 ivan@ivan.com -1  Pesho 120.00 pesho@abv.bg 28 |
| 6  Stanimir 496.37 Temp Coding stancho@yahoo.com  Yovcho 610.13 Manager Sales  Toshko 609.99 Manager Sales toshko@abv.bg 44  Venci 0.02 Director BeerDrinking beer@beer.br 23  Andrei 700.00 Director Coding  Popeye 13.3333 Sailor SpinachGroup popeye@pop.ey | Highest Average Salary: Sales  Yovcho 610.13 n/a -1  Toshko 609.99 toshko@abv.bg 44 |

## Speed Racing

Write a program that keeps track of **cars** and their **fuel** and supports methods for **moving** the cars. Define a class **Car**. Each Car has the following properties:

* **string Model**
* **double FuelAmount**
* **double FuelConsumptionPer**K**ilometer**
* **double Travelled distance**

A car’s model is **unique** - there will never be 2 cars with the same model. On the first line of the input, you will receive a number **N** – the **number** of **cars** you need to track. On each of the next **N** lines, you will receive information about a car in the following format:

**"{model} {fuelAmount} {fuelConsumptionFor1km}"**

All **cars start at 0 kilometers traveled**. After the **N** lines, until the command **"End"** is received, you will receive commands in the following format:

"**Drive {carModel} {amountOfKm}**"

Implement a method in the **Car** class to calculate whether or not a car can **move** that **distance**. If it can, the car’s **fuel amount** should be **reduced** by the amount of **used** **fuel** and its **traveled** **distance** should be increased by the number of the **traveled kilometers**. Otherwise, the car should not move (its fuel amount and the traveled distance should stay the same) and you should print on the console:

"**Insufficient fuel for the drive**"

After the "**End**" command is received, print **each car** and its **current fuel amount** and the **traveled** **distance** in the format:

"**Model {fuelAmount} {distanceTraveled}**"

Print the fuel amount formatted **two digits** after the decimal separator.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 2  AudiA4 23 0.3  BMW-M2 45 0.42  Drive BMW-M2 56  Drive AudiA4 5  Drive AudiA4 13  End | AudiA4 17.60 18  BMW-M2 21.48 56 |
| 3  AudiA4 18 0.34  BMW-M2 33 0.41  Ferrari-488Spider 50 0.47  Drive Ferrari-488Spider 97  Drive Ferrari-488Spider 35  Drive AudiA4 85  Drive AudiA4 50  End | Insufficient fuel for the drive  Insufficient fuel for the drive  AudiA4 1.00 50  BMW-M2 33.00 0  Ferrari-488Spider 4.41 97 |

## Raw Data

Write a program that tracks **cars** and their **cargo**. Define a class **Car** that holds an information about **model, engine, cargo** and a **collection of exactly 4 tires**. The **engine**, **cargo** and **tire** shouldbe **separate classes**. Create a **constructor** that receives all of the information about the **Car** and creates and **initializes** its inner **components** (**engine**, **cargo** and **tires**).

On the first line of input, you will receive a number **N** - the number of cars you have. On each of the next **N** lines, you will receive an information about each car in the format:

"**{model} {engineSpeed} {enginePower} {cargoWeight} {cargoType} {tire1Pressure} {tire1Age} {tire2Pressure} {tire2Age} {tire3Pressure} {tire3Age} {tire4Pressure} {tire4Age}"**

The speed, power, weight and tire age are **integers** and **tire** **preassure** is a **double.**

After the **N** lines, you will receive a single line with one of the following commands:

* "**fragile**" - print all cars whose **cargo** is **"fragile"** with **a tire**, whose **pressure is** **< 1**
* "**flamable**" - print all of the cars, whose **cargo** is **"flamable"** and have **engine power > 250**

The cars should be printed in order of appearing in the input.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 2  ChevroletAstro 200 180 1000 fragile 1.3 1 1.5 2 1.4 2 1.7 4  Citroen2CV 190 165 1200 fragile 0.9 3 0.85 2 0.95 2 1.1 1  fragile | Citroen2CV |
| 4  ChevroletExpress 215 255 1200 flamable 2.5 1 2.4 2 2.7 1 2.8 1  ChevroletAstro 210 230 1000 flamable 2 1 1.9 2 1.7 3 2.1 1  DaciaDokker 230 275 1400 flamable 2.2 1 2.3 1 2.4 1 2 1  Citroen2CV 190 165 1200 fragile 0.8 3 0.85 2 0.7 5 0.95 2  flamable | ChevroletExpress  DaciaDokker |

## Rectangle Intersection

Create a class **Rectangle**. It should consist of an **id, width, height** and the **coordinates of its top left corner** (**horizontal and vertical**). Create a **method**, which receives as a parameter another **Rectangle**, checks if the two rectangles **intersect** and returns **"true"** or **"false"**.

On the first line, you will receive the **number of rectangles** – **N** and the number of **intersection checks** – **M**. On the next **N** lines, you will get the rectangles with their **id, width, height and coordinates**. On the last **M** lines, you will get **pairs of ids**, which represent rectangles. Print if each of the pairs **intersect.**

You will always receive a valid data. There is no need to check if a rectangle exists.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 2 1  Pesho 2 2 0 0  Gosho 2 2 0 0  Pesho Gosho | true |

## Car Salesman

Define two classes **Car** and **Engine.**

**Car** has the following properties:

* **Model**
* **Engine**
* **Weight**
* **Color**

Engine has the following properties:

* **Model**
* **Power**
* **Displacement**
* **Efficiency**

A Car’s **weight** and **color** and its Engine’s **displacement** and **efficiency** are **optional**.

On the first line, you will read a number **N,** which will specify how many lines of engines you will receive. On each of the next **N** lines, you will receive information about an **Engine** in the following format:

**"{Model} {Power} {Displacement} {Efficiency}"**

After the lines with engines, you will receive a number **M**. On each of the next **M** lines, an information about a **Car** will follow in the format:

**"{Model} {Engine} {Weight} {Color}"**

The engine will be the **model of an existing** **Engine**. When creating the object for a **Car**, you should keep a **reference to the real engine** in it, instead of just the engine’s model. Note that the optional properties **might be missing** from the formats.

Your task is to **print** all the **cars** in the order they were received and their information in the format defined bellow. If any of the optional fields is missing, print "**n/a**" in its place:

{CarModel}:  
 {EngineModel}:  
 Power: {EnginePower}  
 Displacement: {EngineDisplacement}  
 Efficiency: {EngineEfficiency}  
 Weight: {CarWeight}  
 Color: {CarColor}

### Bonus\*

Override the classes’ **ToString()** methods to have a reusable way of displaying the objects.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 2  V8-101 220 50  V4-33 140 28 B  3  FordFocus V4-33 1300 Silver  FordMustang V8-101  VolkswagenGolf V4-33 Orange | FordFocus:  V4-33:  Power: 140  Displacement: 28  Efficiency: B  Weight: 1300  Color: Silver  FordMustang:  V8-101:  Power: 220  Displacement: 50  Efficiency: n/a  Weight: n/a  Color: n/a  VolkswagenGolf:  V4-33:  Power: 140  Displacement: 28  Efficiency: B  Weight: n/a  Color: Orange |
| 4  DSL-10 280 B  V7-55 200 35  DSL-13 305 55 A+  V7-54 190 30 D  4  FordMondeo DSL-13 Purple  VolkswagenPolo V7-54 1200 Yellow  VolkswagenPassat DSL-10 1375 Blue  FordFusion DSL-13 | FordMondeo:  DSL-13:  Power: 305  Displacement: 55  Efficiency: A+  Weight: n/a  Color: Purple  VolkswagenPolo:  V7-54:  Power: 190  Displacement: 30  Efficiency: D  Weight: 1200  Color: Yellow  VolkswagenPassat:  DSL-10:  Power: 280  Displacement: n/a  Efficiency: B  Weight: 1375  Color: Blue  FordFusion:  DSL-13:  Power: 305  Displacement: 55  Efficiency: A+  Weight: n/a  Color: n/a |

## Pokemon Trainer

Define a class **Trainer** and a class **Pokemon**.

**Trainers** have:

* **Name**
* **Number of badges**
* **A collection of pokemon**

**Pokemon** have:

* **Name**
* **Element**
* **Health**

All values are **mandatory**. Every Trainer **starts with 0 badges**.

You will be receiving lines until you receive the command "**Tournament**". Each line will carry information about a pokemon and the trainer who caught it in the format:

**"{trainerName} {pokemonName} {pokemonElement} {pokemonHealth}"**

**TrainerName** is the name of the Trainer who caught the pokemon. Trainers’ names are **unique**.  
After receiving the command "**Tournament**", you will start receiving commands until the "**End**" command is received. They can contain one of the following:

* **"Fire"**
* **"Water"**
* **"Electricity"**

For every command you must check if a trainer has at least 1 pokemon with the given element. If he does, he receives 1 badge. Otherwise, all of his pokemon **lose 10 health**. If a pokemon falls **to 0 or less health**, **he dies** and must be deleted from the trainer’s collection. In the end, you should print all of the trainers, **sorted by the amount of badges they have in descending order** (if two trainers have the same amount of badges, they should be sorted by order of appearance in the input)in the format:

**"{TrainerName} {Badges} {NumberOfPokemon}"**

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| Pesho Charizard Fire 100  Gosho Squirtle Water 38  Pesho Pikachu Electricity 10  Tournament  Fire  Electricity  End | Pesho 2 2  Gosho 0 1 |
| Stamat Blastoise Water 18  Nasko Pikachu Electricity 22  Jicata Kadabra Psychic 90  Tournament  Fire  Electricity  Fire  End | Nasko 1 1  Stamat 0 0  Jicata 0 1 |

## Google

Design a class that can hold **all** of the **information** they need **for** **people**. You will be receiving lines until the "**End**" command is given. On each of those lines, there will be = information about a person in one of the following formats:

* "**{Name} company {companyName} {department} {salary}**"
* "**{Name} pokemon {pokemonName} {pokemonType}"**
* "**{Name} parents {parentName} {parentBirthday}**"
* "**{Name} children {childName} {childBirthday}**"
* "**{Name} car {carModel} {carSpeed}**"

You should structure all of the information about a person in a class with nested subclasses. People’s names are **unique** - there won’t be 2 people with the same name. A person can also have **only one** **company** and **one** **car**, but can have **multiple** **parents, children** and **pokemons**. After the command "**End**" is received, on the next line you will receive a single name. You should print all the information about that person. Note that information can change during the input - for instance if we receive multiple lines, which specify a person’s company, only the **last one** should be the one remembered. The salary must be formatted to **two digits** after the decimal seperator.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| PeshoPeshev company PeshInc Management 1000.00  TonchoTonchev car Trabant 30  PeshoPeshev pokemon Pikachu Electricity  PeshoPeshev parents PoshoPeshev 22/02/1920  TonchoTonchev pokemon Electrode Electricity  End  TonchoTonchev | TonchoTonchev  Company:  Car:  Trabant 30  Pokemon:  Electrode Electricity  Parents:  Children: |
| JelioJelev pokemon Onyx Rock  JelioJelev parents JeleJelev 13/03/1933  GoshoGoshev pokemon Moltres Fire  JelioJelev company JeleInc Jelior 777.77  JelioJelev children PudingJelev 01/01/2001  StamatStamatov pokemon Blastoise Water  JelioJelev car AudiA4 180  JelioJelev pokemon Charizard Fire  End  JelioJelev | JelioJelev  Company:  JeleInc Jelior 777.77  Car:  AudiA4 180  Pokemon:  Onyx Rock  Charizard Fire  Parents:  JeleJelev 13/03/1933  Children:  PudingJelev 01/01/2001 |

### Bonus\*

Override the **ToString()** method in the classes to standardize the displaying of objects.

## Family Tree

Create a program that keeps information about a family tree. On the first line of input you will receive either a name or a birthdate in the format:

* **"{FirstName} {LastName}”**
* **"day/month/year**"

Your task is to find the person’s information in the family tree. On the next lines until the command "**End**" is received, you will receive information about your predecessors that you will use to build the family tree.

The information will be in one of the following formats:

* "**FirstName LastName - FirstName LastName**"
* "**FirstName LastName - day/month/year**"
* "**day/month/year - FirstName LastName**"
* "**day/month/year - day/month/year**"
* "**FirstName LastName day/month/year**"

The first four formats reveal a family tie – **the person on the left is parent to the person on the right** (as you can see the format does not need to contain names, for example the 4th format means the person born on the left date is parent to the person born on the right date). The last format ties different information together – i.e. **the person with that name was born on that date**. **Names** and **birthdates** are **unique** – there won’t be 2 people with the same name or birthdate. There will **always** be enough entries to construct the family tree (all people’s names and birthdates are known and they have at least one connection to another person in the tree).

After the command "**End**" is received, you should print all the information about the person, whose name or birthdate you’ve received on the first line – his **name, birthday, parents and children** (check the examples for the format). The people in the parents’ and childrens’ lists should be ordered by their **first** **appearance** in the input (regardless if they appeared as a birthdate or a name, for example in the first input Stamat is before Penka because he has appeared first on the second line, while she appears on the third one).

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| Pesho Peshev  11/11/1951 - 23/5/1980  Penka Pesheva - 23/5/1980  Penka Pesheva 9/2/1953  Pesho Peshev - Gancho Peshev  Gancho Peshev 1/1/2005  Stamat Peshev 11/11/1951  Pesho Peshev 23/5/1980  End | Pesho Peshev 23/5/1980  Parents:  Stamat Peshev 11/11/1951  Penka Pesheva 9/2/1953  Children:  Gancho Peshev 1/1/2005 |
| 13/12/1993  25/3/1934 - 4/4/1961  Poncho Tonchev 25/3/1934  4/4/1961 - Moncho Tonchev  Toncho Tonchev - Lomcho Tonchev  Moncho Tonchev 13/12/1993  Lomcho Tonchev 7/7/1995  Toncho Tonchev 4/4/1961  End | Moncho Tonchev 13/12/1993  Parents:  Toncho Tonchev 4/4/1961  Children: |

## \* SoftUni Parking

#### Preparation

Download the skeleton provided in Judge. **Do not** change the **StartUp** class or its **namespace**.

#### Problem description

Your task is to create a repository, which stores cars by creating the classes described below.

First, write a C# class **Car** with the following properties:

* **Make: string**
* **Model: string**
* **HorsePower: int**
* **RegistrationNumber: string**

|  |
| --- |
| **public class** Car  {   *//* ***TODO: implement this class*** } |

The class' **constructor** should receive **make, model, horsePower** and **registrationNumber** and override the **ToString()** method in the following format:

**"Make: {make}"**

**"Model: {model}"**

**"HorsePower: {horse power}"**

**"RegistrationNumber: {registration number}"**

Write a C# class **Parking** that has **Cars** (a collection which stores the entity **Car**). All entities inside the class have the **same properties**.

|  |
| --- |
| **public class** Parking  {  *//* ***TODO: implement this class*** } |

The class' **constructor** should initialize the **Cars** with a new instance of the collection and accept **capacity** as a parameter**.**

Implement the following fields:

* Field **cars** – a **collection** that holds added cars.
* Field **capacity** – accessed only by the base class (responsible for the parking capacity).

Implement the following **methods**:

#### **AddCar(Car car)**

The method first checks if there is already a car with the provided car registration number and if there is, the method returns the following message:

"Car with that registration number, already exists!"

Next checks if the count of the cars in the parking is more than the capacity and if it is returns the following message:

"Parking is full!"

Finally if nothing from the previous conditions is true it just adds the current car to the cars in the parking and returns the message:

"Successfully added new car {Make} {RegistrationNumber}"

#### **RemoveCar(string registrationNumber)**

Removes a car with the given registration number. If the provided registration number does not exist returns the message:

"Car with that registration number, doesn't exist!"

Otherwise, removes the car and returns the message:

"Successfully removed {registrationNumber}"

#### **GetCar(string registrationNumber)**

Returns the **Car** with the provided registration number.

#### **RemoveSetOfRegistrationNumber(List<string> registrationNumbers)**

A void method, which removes all cars that have the provided registration numbers. Each car is removed only if the registration number exists.

#### **Count**

Returns the number of stored cars.

#### Examples

This is an example how the **Parking** class is **intended to be used**.

|  |
| --- |
| Sample code usage |
| var car = new Car("Skoda", "Fabia", 65, "CC1856BG");  var car2 = new Car("Audi", "A3", 110, "EB8787MN");  Console.WriteLine(car.ToString());  //Make: Skoda  //Model: Fabia  //HorsePower: 65  //RegistrationNumber: CC1856BG  var parking = new Parking(5);  Console.WriteLine(parking.AddCar(car));  //Successfully added new car Skoda CC1856BG  Console.WriteLine(parking.AddCar(car));  //Car with that registration number, already exists!  Console.WriteLine(parking.AddCar(car2));  //Successfully added new car Audi EB8787MN  Console.WriteLine(parking.GetCar("EB8787MN").ToString());  //Make: Audi  //Model: A3  //HorsePower: 110  //RegistrationNumber: EB8787MN    Console.WriteLine(parking.RemoveCar("EB8787MN"));  //Successfullyremoved EB8787MN  Console.WriteLine(parking.Count); //1 |

#### Submission

Zip all the files in the project folder accept **bin** and **obj** folders.