

# Exercises: Defining Classes

This document defines the **exercise assignments** for the ["CSharp OOP Basics" course @ Software University](#).

Please submit your solutions (source code) of all below described problems in [Judge](#).

## Problem 1. Define a Class Person

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.

## Problem 2. Creating Constructors

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

1. The first should take no arguments and produce a person with name **"No name"** and age = **1**.
2. 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.
3. 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.

## Problem 3. Oldest Family Member

Use your **Person** class from the previous tasks. Create a class **Family**. The class should have **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

Input	Output
5 Steve 10 Christopher 15 Annie 4 Ivan 35 Maria 34	Ivan 35

## Problem 4. 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

## Problem 5. 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 the** difference in the days between them.

### Examples

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

## Problem 6. 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** – in place of that field you should print **"n/a"** instead, if he doesn't have an **age** – print **"-1"** instead. The **salary** should be printed to **two decimal places** after the separator.

### 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	Highest Average Salary: Development Ivan 840.20 ivan@ivan.com -1 Pesho 120.00 pesho@abv.bg 28

Gosho 0.20 Freeloader Nowhere 18	
6 Stanimir 496.37 Temp Coding stanch@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

## Problem 7. Speed Racing

Your task is to implement a program that keeps track of cars and their fuel and supports methods for moving the cars. Define a class **Car** that keeps track of a car's **model**, **fuel amount**, **fuel consumption for 1 kilometer** and **distance traveled**. 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 for 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 **distance traveled** should be increased by the number of **kilometers traveled**. Otherwise, the car should not move (its fuel amount and distance traveled 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 **distance traveled** in the format “<Model> <fuelAmount> <distanceTraveled>”. Print the fuel amount rounded to **two decimal places** after the 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

## Problem 8. Raw Data

You are the owner of a courier company and want to make a system for tracking your cars and their cargo. Define a class **Car** that holds information about **model**, **engine**, **cargo** and a **collection of exactly 4 tires**. The **engine**, **cargo**

and **tire** should be **separate classes**. Create a constructor that receives all 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 amount of cars you have. On each of the next **N** lines you will receive information about a car in the format "**<Model> <EngineSpeed> <EnginePower> <CargoWeight> <CargoType> <Tire1Pressure> <Tire1Age> <Tire2Pressure> <Tire2Age> <Tire3Pressure> <Tire3Age> <Tire4Pressure> <Tire4Age>**" where the speed, power, weight and tire age are **integers**, tire pressure is a **double**.

After the **N** lines you will receive a single line with one of 2 commands: "**fragile**" or "**flamable**". If the command is "**fragile**" print all cars whose **Cargo Type** is "**fragile**" with a **tire** whose **pressure** is **< 1**. If the command is "**flamable**" print all cars whose **Cargo Type** 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

## Problem 9. 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 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

## Problem 10. Car Salesman

Define two classes **Car** and **Engine**. A **Car** has a **model**, **engine**, **weight** and **color**. An **Engine** has **model**, **power**, **displacement** and **efficiency**. A **Car's weight** and **color** and its **Engine's displacements** 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, on the next line you will receive a number **M** – specifying the number of Cars that will follow. On each of the next **M** lines information about a **Car** will follow in the format “<Model> <Engine> <Weight> <Color>”, where 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 each car (in the order you received them) and its information in the format defined bellow, if any of the optional fields has not been given print “**n/a**” in its place instead:

```
<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: Power: 305 Displacement: 55 Efficiency: A+ Weight: n/a

FordMondo DSL-13 Purple VolkswagenPolo V7-54 1200 Yellow VolkswagenPassat DSL-10 1375 Blue FordFusion DSL-13	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
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## Problem 11. Pokemon Trainer

You wanna be the very best pokemon trainer, like no one ever was, so you set out to catch pokemon. Define a class **Trainer** and a class **Pokemon**. Trainers have a **name**, **number of badges** and a **collection of pokemon**, **Pokemon** have a **name**, an **element** and **health**, all values are **mandatory**. Every Trainer **starts with 0 badges**.

From the console you will receive an unknown number of 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>"** where **TrainerName** is the name of the Trainer who caught the pokemon. Trainer names are **unique**.

After receiving the command **"Tournament"**, an unknown number of lines containing one of the three elements **"Fire"**, **"Water"**, **"Electricity"** will follow until the **"End"** command is received. 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.

After the **"End"** command is received you should print all 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	Pesho 2 2 Gosho 0 1

End	
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

## Problem 12. Google

Google is always watching you, so it should come as no surprise that they **know everything about you** (even your pokemon collection). Since you're really good at writing classes, Google asked you to design a class that can hold **all** the **information** they need **for people**.

From the console you will receive an unknown amount of lines until the command **"End"** is read. 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 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 1 company** and **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 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 decimal places** after the separator.

## Examples

Input	Output
PeshoPeshev company PeshInc Management 1000.00 TonchoTonchev car Trabant 30 PeshoPeshev pokemon Pikachu Electricity PeshoPeshev parents PeshoPeshev 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	JelioJelev Company: JeleInc Jelior 777.77 Car: AudiA4 180 Pokemon: Onyx Rock Charizard Fire

End JelioJelev	Parents: JeleJelev 13/03/1933 Children: PudingJelev 01/01/2001
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## Bonus\*

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

## Problem 13. Family Tree

You want to build your family tree, so you went to ask your grandmother. Sadly, your grandmother keeps remembering information about your predecessors in pieces, so it falls to you to group the information and build the family tree.

On the first line of input you will receive either a name or a birthdate in the format “<FirstName> <LastName>” or “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 4 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 4<sup>th</sup> 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 atleast one connection to another person in the tree).

After the command “End” is received you should print all information about the person whose name or birthdate you 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 Parents: Stamat Peshev 11/11/1951 Penka Pesheva 9/2/1953 Children: Gancho Peshev 1/1/2005



Pesho Peshev 23/5/1980 End	
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:

## Problem 14. \*Cat Lady

Ginka has many cats of various breeds in her house. Since some breeds have specific characteristics, Ginka needs some way to catalogue the cats. Help her by creating a class hierarchy with all her breeds of cats, so she can easily check on their characteristics. Ginka has 3 specific breeds of cats: “Siamese”, “Cymric” and the very famous bulgarian breed “Street Extraordinaire”. Each breed has a specific characteristic about which information should be kept. For the Siamese cats their **ear size** should be kept, for Cymric cats - the **length of their fur** in centimeters and for the Street Extraordinaire - the **decibels of their meowing** during the night.

From the console you will receive lines of information with cats. Until the command “**End**” is received, the information will come in one of the following formats:

- “Siamese <name> <earSize>”
- “Cymric <name> <furLength>”
- “StreetExtraordinaire <name> <decibelsOfMeows>”

On the last line after the “**End**” command you will receive the name of a cat. You should print that cat’s information in the same format in which you received it (with **fur size** being formatted to **two decimal places** after the separator).

## Constraints

- Ear size and decibels will always be **positive integers**
- Cat names are **unique**

## Example

Input	Output
StreetExtraordinaire Maca 85 Siamese Sim 4 Cymric Tom 2.80 End Tom	Cymric Top 2.80
StreetExtraordinaire Koti 80 StreetExtraordinaire Maca 100 Cymric Tim 3.10 End Maca	StreetExtraordinaire Maca 100

## Hint

Use class inheritance to represent the cat hierarchy and override the ToString() methods of concrete breeds to allow for easy printing of the cat, regardless the breed.

## Problem 15. \*Drawing tool

You are a young programmer and your boss gave you a task to create a tool, which draws figures on the console. He knows you are not too good at OOP tasks, so he told you to create a class - **DrawingTool**. Its task is to draw rectangular figures on the console.

**DrawingTool**'s constructor should take as a parameter a **Square** or a **Rectangle** object, extract its characteristics and draw the figure. Like we said, your boss is a good guy and he has some more info for you:

One of the extra classes you will need should be a class named **Square** that should have only one method – **Draw()** which uses the length of the square's sides and draws them on the console. For horizontal lines, use dashes ("-") and spaces (" "). For vertical lines – pipes ("|"). If the size of the figure is 6, the dashes should also be 6.

## Hint

Search in the internet for abstract classes and try implementing one. This will help you to reduce the input parameters in the **DrawingTool**'s constructor to one.

## Examples

Input	Output	Comment
Square 3	<pre>  ---             ---  </pre>	Square's size is 3 so we draw 3 pipes down and 3 dashes across

Input	Output	Comment
Rectangle 7 3	<pre>  -----                 -----  </pre>	The Rectangle's width is 7 and the length is 3