# Exercises: Polymorphism

This document defines the exercises for ["C# OOP Basics" course @ Software University](https://softuni.bg/courses/csharp-oop-basics).  
Please submit your solutions (source code) of all below described problems in [Judge](https://judge.softuni.bg/Contests/241/Polymorphism-Exercise).

## Vehicles

Write a program that models 2 vehicles (**Car** and **Truck**) and simulates **driving** and **refueling** them. **Car** and **truck** both have **fuel quantity**, **fuel consumption** **in liters** **per km** and can be **driven a given distance** and **refueled with a given amount of fuel.** It’s summer, so both vehicles use air conditioners and their **fuel consumption** per km is **increased** by **0.9** liters for the **car** and with **1.6** liters for the **truck**. Also, the **truck** has a tiny hole in its tank and when its **refueled** it keeps only **95%** of the given **fuel**. The **car** has no problems and adds **all the given fuel to its tank.** If a vehicle cannot travel the given distance, its fuel does not change.

### Input

* On the **first** **line** **–** information about the **car** inthe **format:** **"Car {fuel quantity} {liters per km}"**
* On the **second** **line** – info about the truck inthe **format:** **"Truck {fuel quantity} {liters per km}"**
* Onthe **third** **line** **–** the **number** of **commands** N that will be given on the next N **lines**
* On the next N lines – commands in **the** format**:**
* **"Drive Car {distance}"**
* **"Drive Truck {distance}"**
* **"Refuel Car {liters}"**
* **"Refuel Truck {liters}"**

### Output

* **After each** Drivecommand**, if there was** enough **fuel,** print **on the console a** message **in the format:**
* **"Car/Truck travelled {distance} km"**
* Iftherewas **not enough fuel**,print**: "Car/Truck needs refueling"**
* After the End command, print the remaining fuel for both the car and the truck, **rounded** to **2 digits** after the floating point in the format:
* **"Car: {liters}"**
* **"Truck: {liters}"**

### Examples

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| **Input** | **Output** |
| Car 15 0.3  Truck 100 0.9  4  Drive Car 9  Drive Car 30  Refuel Car 50  Drive Truck 10 | Car travelled 9 km  Car needs refueling  Truck travelled 10 km  Car: 54.20  Truck: 75.00 |
| Car 30.4 0.4  Truck 99.34 0.9  5  Drive Car 500  Drive Car 13.5  Refuel Truck 10.300  Drive Truck 56.2  Refuel Car 100.2 | Car needs refueling  Car travelled 13.5 km  Truck needs refueling  Car: 113.05  Truck: 109.13 |

## Vehicles Extension

Use your solution of the **previous** task for the starting point and add more functionality. Add a new vehicle – **Bus**. Add to every **vehicle** a new property – **tank** **capacity**. A vehicle cannot **start** **with** or **refuel** **above** its **tank** **capacity**.

If you **try to put more fuel** in the tank than the **available space,** print on the console **"Cannot fit {fuel amount} fuel in the tank"** and **do not add any fuel** in the vehicle’s tank. If you try to **create** a vehicle with **more** **fuel** than its **tank** **capacity**, **create** it but start with an **empty** **tank**.

Add a **new command** for the bus. You can **drive** the **bus** **with or without people**. **With people**, the **air-conditioner** **is turned on** and its **fuel consumption** per kilometer is **increased by 1.4 liters**. If there are **no people in the bus**, the air-conditioner is **turned off** and **does not increase** the fuel consumption.

Finally, add **validation** for the **amount** of **fuel** given to the **Refuel** **command** – if it is 0 or negative, print **"Fuel must be a positive number"**.

### Input

* On the **first** **three** **lines** you will receive information about the vehicles in the format:
* **"Vehicle {initial fuel quantity} {liters per km} {tank capacity}"**
* On the **fourth** **line** – the number of **commands** **N** that will be given on the next N lines
* On the **next** **N** **lines** – commands in format:
* **"Drive Car {distance}"**
* **"Drive Truck {distance}"**
* **"Drive Bus {distance}"**
* **"DriveEmpty Bus {distance}"**
* **"Refuel Car {liters}"**
* **"Refuel Truck {liters}"**
* **"Refuel Bus {liters}"**

### Output

* **After each** Drivecommand**, if there was** enough **fuel,** print **on the console a** message **in the format:**
* **"Car/Truck travelled {distance} km"**
* Iftherewas **not enough fuel**,print**:**
* **"Car/Truck needs refueling"**
* If you try to **refuel** with an **amount ≤ 0** print:
* **"Fuel must be a positive number"**
* If the given **fuel** **cannot** fit in the **tank**, print:
* **"Cannot fit {fuel amount} fuel in the tank"**
* After the End command, print the remaining fuel for all vehicles, **rounded** to **2 digits** after the floating point in the format:
* **"Car: {liters}"**
* **"Truck: {liters}"**
* **"Bus: {liters}"**

### Example

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| **Input** | **Output** |
| Car 30 0.04 70  Truck 100 0.5 300  Bus 40 0.3 150  8  Refuel Car -10  Refuel Truck 0  Refuel Car 10  Refuel Car 300  Drive Bus 10  Refuel Bus 1000  DriveEmpty Bus 100  Refuel Truck 1000 | Fuel must be a positive number  Fuel must be a positive number  Cannot fit 300 fuel in the tank  Bus travelled 10 km  Cannot fit 1000 fuel in the tank  Bus needs refueling  Cannot fit 1000 fuel in the tank  Car: 40.00  Truck: 100.00  Bus: 23.00 |

## Wild Farm

Your task is to create a **class** **hierarchy** like **described** **below**. The **Animal**, **Bird**, **Mammal**, **Feline** and **Food** classes should be **abstract**. Override the method **ToString()**.

* **Food – int Quantity;**
  + **Vegetable;**
  + **Fruit;**
  + **Meat;**
  + **Seeds;**
* **Animal – string Name, double Weight, int FoodEaten;**
  + **Bird – double WingSize;**
    - **Owl;**
    - **Hen;**
  + **Mammal – string LivingRegion;**
    - **Mouse;**
    - **Dog;**
    - **Feline;**
      * **Cat – string Breed;**
      * **Tiger – string Breed;**

All **animals** should also have the **ability** to ask for food by **producing** a **sound**.

* **Owl – "Hoot Hoot";**
* **Hen – "Cluck";**
* **Mouse – "Squeak";**
* **Dog – "Woof!";**
* **Cat – "Meow";**
* **Tiger – "ROAR!!!";**

Now use the **classes** you’ve created to **instantiate** some **animals** and **feed** **them**.  
Input should be read from the console. Every **even** line (starting from 0) will **contain** **information** about an **animal** in the following format:

* **Felines - "{Type} {Name} {Weight} {LivingRegion} {Breed}";**
* **Birds - "{Type} {Name} {Weight} {WingSize}";**
* **Mice and Dogs = "{Type} {Name} {Weight} {LivingRegion}";**

On the **odd** lines you will receive **information** about a piece of **food** that you should **give** to that **animal**. The line will consist of a **FoodType** and **quantity**, separated by a whitespace.

Animals will only eat a certain type of food, as follows:

* **Hens** eat **everything**;
* **Mice** eat **vegetables** and **fruits**;
* **Cats** east **vegetables** and **meat**;
* **Tigers**, **Dogs** and **Owls** eat **only** **meat**;

If you try to give an animal a different type of food, it will not eat it and you should print:

* **"{AnimalType} does not eat {FoodType}!"**

The **weight** of an **animal** will **increase** with **every** **piece** of **food** it **eats**, as follows:

* **Hen – 0.35;**
* **Owl – 0.25;**
* **Mouse – 0.10;**
* **Cat – 0.30;**
* **Dog – 0.40;**
* **Tiger – 1.00;**

Override the **ToString()** method to print the information about an animal in the formats:

* **Birds –** **"{AnimalType} [{AnimalName}, {WingSize}, {AnimalWeight}, {FoodEaten}]"**
* **Felines – "{AnimalType} [{AnimalName}, {Breed}, {AnimalWeight}, {AnimalLivingRegion}, {FoodEaten}]"**
* **Mice and Dogs –** **"{AnimalType} [{AnimalName}, {AnimalWeight}, {AnimalLivingRegion}, {FoodEaten}]"**

After you read **information** about an **animal** and some **food**, the **animal** will **produce a** **sound** (**print** it on the **console**). Next, you should **try** to **feed** it. After receiving the “**End**” command, **print** information about **every** **animal** in **order** of **input**.

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| **Input** | **Output** |
| Cat Pesho 1.1 Home Persian  Vegetable 4  End | Meow  Cat [Pesho, Persian, 2.3, Home, 4] |
| Tiger Typcho 167.7 Asia Bengal  Vegetable 1  Dog Doncho 500 Street  Vegetable 150  End | ROAR!!!  Tiger does not eat Vegetable!  Woof!  Dog does not eat Vegetable!  Tiger [Typcho, Bengal, 167.7, Asia, 0]  Dog [Doncho, 500, Street, 0] |
| Mouse Jerry 0.5 Anywhere  Fruit 1000  Owl Toncho 2.5 30  Meat 5  End | Squeak  Hoot Hoot  Mouse [Jerry, 100.5, Anywhere, 1000]  Owl [Toncho, 30, 3.75, 5] |