# Lab: Encapsulation

Problems for the ["C# OOP" course @ SoftUni"](https://softuni.bg/trainings/3585/csharp-oop-february-2022).

You can check your solutions here: <https://judge.softuni.org/Contests/1497/Encapsulation-Lab>

## Sort Persons by Name and Age

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

Create a class **Person**, which should have **public** properties with **private** setters for:

* **FirstName**: **string**
* **LastName**: **string**
* **Age**: **int**
* **ToString()**: **string** - **override**

You should be able to use the class like this:

|  |
| --- |
| StartUp.cs |
| public static void Main()  {  var lines = int.Parse(Console.ReadLine());  var persons = new List<Person>();  for (int i = 0; i < lines; i++)  {  var cmdArgs = Console.ReadLine().Split();  var person = new Person(cmdArgs[0], cmdArgs[1], int.Parse(cmdArgs[2]));  persons.Add(person);  }  persons.OrderBy(p => p.FirstName)  .ThenBy(p => p.Age)  .ToList()  .ForEach(p => Console.WriteLine(p.ToString()));  } |

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 5  Brandi Anderson 65  Andrew Williams 57  Newton Holland 27  Andrew Clark 44  Brandi Scott 35 | Andrew Clark is 44 years old.  Andrew Williams is 57 years old.  Brandi Scott is 35 years old.  Brandi Anderson is 65 years old.  Newton Holland is 27 years old. |

### Solution

Create a **new class** and ensure **proper naming**. Define the **public** properties:

|  |
| --- |
| Person.cs |
| public class Person  {  public string FirstName { get; private set; }  public string LastName { get; private set; }  public int Age { get; private set; }  } |

Create a constructor for **Person**, which takes 3 parameters **firstName**, **lastName**, **age**:

|  |
| --- |
| Person.cs |
| public Person(string firstName, string lastName, int age)  {  this.FirstName = firstName;  this.LastName = lastName;  this.Age = age;  } |

Override **ToString()** method:

|  |
| --- |
| Person.cs |
| public override string ToString()  {  return $"{this.FirstName} {this.LastName} is {this.Age} years old.";  } |

## Salary Increase

**NOTE**: You need a public StartUp class with the namespace **PersonsInfo**. **Refactor the project from the last task.**

Create objects of the class **Person**. Read their **name**, **age,** and **salary** from the console. Read the percentage of the bonus to every **Person's** **salary**. People younger than **30** **get half the increase**. Expand **Person** from the previous task.

New **properties** and **methods:**

* **Salary**: **decimal**
* **IncreaseSalary**(**decimal** **percentage**)

You should be able to use the class like this:

|  |
| --- |
| StartUp.cs |
| var lines = int.Parse(Console.ReadLine());  var persons = new List<Person>();  for (int i = 0; i < lines; i++)  {  var cmdArgs = Console.ReadLine().Split();  var person = new Person(cmdArgs[0],  cmdArgs[1],  int.Parse(cmdArgs[2]),  decimal.Parse(cmdArgs[3]));  persons.Add(person);  }  var parcentage = decimal.Parse(Console.ReadLine());  persons.ForEach(p => p.IncreaseSalary(parcentage));  persons.ForEach(p => Console.WriteLine(p.ToString())); |

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 5  Andrew Williams 65 2200  Newton Holland 57 3333  Rachelle Nelson 27 600  Brandi Scott 44 666.66  George Miller 35 559.4  20 | Andrew Williams receives 2640.00 leva.  Newton Holland receives 3999.60 leva.  Rachelle Nelson receives 660.00 leva.  Brandi Scott receives 799.99 leva.  George Miller receives 671.28 leva. |

### Solution

Add a new **public** property for **salary** and **refactor the constructor**. Add a new **method**, which will **update** **salary** with a bonus:

|  |
| --- |
| Person.cs |
| public void IncreaseSalary(decimal percentage)  {  if(this.Age > 30)  {  this.Salary += this.Salary \* percentage / 100;  }  else  {  this.Salary += this.Salary \* percentage / 200;  }  } |

Refactor the **ToString()** method for this task.

## Validation of Data

**NOTE**: You need a public StartUp class with the namespace **PersonsInfo**. The skeleton from the previous task could be used.

Expand **Person** with proper **validation** for every **field**:

* **Name** must be at **least 3 symbols**
* **Age** must **not** be **zero** **or negative**
* **Salary** **can't** be **less than 460 (decimal)**

If some of the properties are **NOT valid** throw [**ArgumentExeption**](https://docs.microsoft.com/en-us/dotnet/api/system.argumentexception?view=net-6.0)with the following messages:

* **"Age cannot be zero or a negative integer!"**
* **"First name cannot contain fewer than 3 symbols!"**
* **"Last name cannot contain fewer than 3 symbols!"**
* **"Salary cannot be less than 650 leva!"**

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 5  Andrew Williams -6 2200  B Gomez 57 3333  Carolina Richards 27 670  Gilbert H 44 666.66  Joshua Anderson 35 300  20 | Age cannot be zero or a negative integer!  First name cannot contain fewer than 3 symbols!  Last name cannot contain fewer than 3 symbols!  Salary cannot be less than 650 leva!  Carolina Richards receives 737.00 leva. |

### Solution

Add validation to all of the setters in **Person**. Validation may look like this or something similar:

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| --- |
| Person.cs |
| public decimal Salary  {  get  {  return this.salary;  }  private set  {  if (value < 650)  {  throw new ArgumentException("Salary cannot be less than 650 leva!");  }  }  } |

## First and Reserve Team

**NOTE**: You need a public StartUp class with the namespace **PersonsInfo**. The skeleton from the previous task could be used.

Create a **Team** class. Add to this team all of the people you have received. Those who are **younger than 40** go to the **first team**, **others** go to the **reserve team**. At the end print the **sizes of the first** and the **reserved team**.

The class should have **private fields** for:

* **name**: **string**
* **firstTeam**: List<Person>
* **reserveTeam**: List<Person>

The class should have **constructors**:

* Team(string name)

The class should also have **public properties** for:

* FirstTeam: List<Person> (read-only!)
* ReserveTeam: List<Person> (read-only!)

And a method for adding players:

* AddPlayer(Person person): void

You should be able to use the class like this:

|  |
| --- |
| StartUp.cs |
| Team team = new Team("SoftUni");  foreach (Person person in persons)  {  team.AddPlayer(person);  } |

You should **NOT** be able to use the class like this:

|  |
| --- |
| StartUp.cs |
| Team team = new Team("SoftUni");  foreach (Person person in persons)  {  if(person.Age < 40)  {  team.FirstTeam.Add(person);  }  else  {  team.ReserveTeam(person);  }  } |

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 5  Andrew Williams 20 2200  Newton Holland 57 3333  Rachelle Nelson 27 600  Grigor Dimitrov 25 666.66  Brandi Scott 35 555 | First team has 4 players.  Reserve team has 1 players. |

### Solution

Add a new class **Team**. Its fields and **constructor** should look like

|  |
| --- |
| Team.cs |
| private string name;  private List<Person> firstTeam;  private List<Person> reserveTeam;  public Team(string name)  {  this.name = name;  this.firstTeam = new List<Person>();  this.reserveTeam = new List<Person>();  } |

Properties for **FirstTeam** and **ReserveTeam** have only **getters**:

|  |
| --- |
| Team.cs |
| public IReadOnlyCollection<Person> FirstTeam  {  get { return this.firstTeam.AsReadOnly(); }  }  public IReadOnlyCollection<Person> ReserveTeam  {  get { return this.reserveTeam.AsReadOnly(); }  } |

There will be only **one method**, which **adds players** to teams:

|  |
| --- |
| Team.cs |
| public void AddPlayer(Person person)  {  if (person.Age < 40)  {  firstTeam.Add(person);  }  else  {  reserveTeam.Add(person);  }  } |