# Exercises: Iterators And Comparators

Problems for exercises and homework for the ["CSharp Advanced" course @ Software University](https://softuni.bg/courses/csharp-advanced).

You can check your solutions in here: <https://judge.softuni.bg/Contests/1490/Iterators-and-Comparators-Exercise>

## ListyIterator

Create a **generic** class "ListyIterator". The collection, which it will iterate through, should be received in the **constructor**. You should **store** the elements in a List. The class should have **three** main functions:

* **Move** - should move an internal index position to the next index in the list. The method should return true, if it had successfully moved the index and false if there is no next index.
* **HasNext** - should return true, if there is a next index and false, if the index is already at the last element of the list.
* **Print** - should print the element at the current internal index. Calling Print on a collection without elements should throw an appropriate exception with the message "**Invalid Operation!**".

By default, the internal index should be pointing to the **0th index** of the List. Your program should support the following commands:

|  |  |  |
| --- | --- | --- |
| **Command** | **Return Type** | **Description** |
| Create {e1 e2 …} | void | Creates a ListyIterator from the specified collection. In case of a Create command without any elements, you should create a ListyIterator with an empty collection. |
| Move | boolean | This command should move the internal index to the next index. |
| Print | void | This command should print the element at the current internal index. |
| HasNext | boolean | Returns whether the collection has a next element. |
| END | void | Stops the input. |

### Input

Input will come from the console as lines of commands. The first line will always be the **only** Create command in the input. The last command received will always be the only **END** command.

### Output

For every command from the input (with the exception of the **END** and **Create** commands) print the result of that command on the console, each on a new line. In case of **Move** or **HasNext** commands, print the return value of the methods, in case of a **Print** command you don’t have to do anything additional as the method itself should already print on the console. Your program should catch any exceptions thrown because of validations (calling Print on an empty collection) and print their messages instead.

### Constraints

* There will always be only **1** **Create** command and it will always be the first command passed.
* The number of commands received will be between **[1…100]**.
* The last command will always be the only **END** command.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| Create  Print  END | Invalid Operation! |
| Create Stefcho Goshky  HasNext  Print  Move  Print  END | True  Stefcho  True  Goshky |
| Create 1 2 3  HasNext  Move  HasNext  HasNext  Move  HasNext  END | True  True  True  True  True  False |

## Collection

Using the ListyIterator from the last problem, extend it by **implementing** the **IEnumerable<T>** interface, implement all methods desired by the interface manually (use **yield return** for **GetEnumerator()** method). Add a new command **PrintAll** that should foreach the collection and **print all of the elements** on a **single line separated by a space**.

### Input

Input will come from the console as lines of commands. The first line will always be the **only** Create command in the input. The last command received will always be the only **END** command.

### Output

For every command from the input (with the exception of the **END** and **Create** commands) print the result of that command on the console, each on a new line. In case of **Move** or **HasNext** commands print the return value of the method, in case of a **Print** command you don’t have to do anything additional as the method itself should already print on the console. In case of a **PrintAll** command you should print all of the elements on a single line separated by spaces. Your program should catch any exceptions thrown because of validations and print their messages instead.

### Constraints

* **Do NOTuse the GetEnumerator() method from the base class. Use your own implementation using “yield return”**
* There will always be only **1** **Create** command and it will always be the first command passed.
* The number of commands received will be between **[1…100]**.
* The last command will always be the only **END** command.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| Create 1 2 3 4 5  Move  PrintAll  END | True  1 2 3 4 5 |
| Create Stefcho Goshky Peshu  PrintAll  Move  Move  Print  HasNext  END | Stefcho Goshky Peshu  True  True  Peshu  False |

## Stack

Since you have passed the basic algorithms course, now you have a task to create your custom stack. You are aware of the Stack's structure. There is a collection to store the elements and two functions (not from the functional programming) - to push an element and to pop it. Keep in mind that the first element, which is popped is the last in the collection. The Push method adds an element at the top of the collection and the Pop method returns the top element and removes it.

Write your custom implementation of **Stack<T>** and implement **IEnumerable<T>** interface. Your implementation of the **GetEnumerator()** method should follow the rules of the Abstract Data Type – **Stack** (return the elements in reverse order of adding them to the stack)

### Input

The input will come from the console as lines of commands. Commands will only be **push** and **pop**, followed by integers for the **push** command and no another input for the **pop** command.

Format:

* **Push {element1}, {element2}, … {elementN} –** add given elements to the stack
* **Pop –** removes the last pushed element from the stack

### Output

When you receive **END**, the input is over. Foreach the stack **twice** and print all elements each on new line.

### Constraints

* The elements in the push command will be valid integers between **[2-31…231-1]**.
* The commands will always be valid (always be either **Push, Pop** or **END**).
* If Pop command could not be executed as expected (e.g. no elements in the stack), print on the console: "**No elements**".

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| Push 1, 2, 3, 4  Pop  Pop  END | 2  1  2  1 |
| Push 1, 2, 3, 4  Pop  Push 1  END | 1  3  2  1  1  3  2  1 |
| Push 1, 2, 3, 4  Pop  Pop  Pop  Pop  Pop  END | No elements |

## Froggy

Let's play a game. You have a tiny little **Frog**, and a **Lake** that has a path of stones in it. Every **stone has a number**. Our frog must **cross the lake** along that path and **then return**. But there are some rules when jumping on the stones. First, the frog must **jump on all even positions** of the stones in ascending order and **then on all odd positions** but in **reversed order**. The order of the stones and their numbers will be given on the first line of input. Then you must **print the order of stones in which our frog jumped** from one to another.



Try to achieve this functionality by creating a **class Lake** (it will hold **all stone numbers in order**) that implements **IEnumerable<int>** interface and overrides its **GetEnumerator()** methods.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 1, 2, 3, 4, 5, 6, 7, 8 | 1, 3, 5, 7, 8, 6, 4, 2 |
| 1, 2, 3, 4, 5 | 1, 3, 5, 4, 2 |
| 13, 23, 1, -8, 4, 9 | 13, 1, 4, 9, -8, 23 |

## Comparing Objects

Create a **class Person**. Each person should have a **name**, an **age** and a **town**. You should implement the interface – **IComparable<T>** and implement the **CompareTo** method. When you compare two people, first you should **compare their names**, after that – **their age** and finally – **their towns**.

### Input

On every line, you will be given people in format:

**{name} {age} {town}**

Collect them till you receive **"END"**

After that, you will receive an integer **N** – the **Nth** person in your collection. **Starting from 1.**

### Output

On the single output line, you should bring statistics, how many people are equal to him, how many people are not equal to him and the total people in your collection.

Format: **{number of equal people} {number of not equal people} {total number of people}**

### Constraints

Input names, ages and addresses will be valid. Input number will always be а valid integer in range **[2…100]**

If there are no equal people print: **"No matches"**

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| Pesho 22 Vraca  Gogo 14 Sofeto  END  2 | No matches |
| Pesho 22 Vraca  Gogo 22 Vraca  Gogo 22 Vraca  END  2 | 2 1 3 |

## Strategy Pattern

An interesting pattern you may have heard of is the **Strategy Pattern**. If we have multiple ways to do a task (say **sort a collection**), it allows the client to **choose the way that fits his needs the most**. A famous implementation of the pattern in C# are the [**List<T>.Sort()**](https://msdn.microsoft.com/en-us/library/234b841s(v=vs.110).aspx) and [**Array.Sort()**](https://msdn.microsoft.com/en-us/library/aw9s5t8f(v=vs.110).aspx) methods that take an **IComparer** as an argument.

Create a class **Person** that holds a **name** and an **age**. Create 2 Comparators for **Person** (classes, which implement the **IComparer<Person>** interface). The first comparator should compare people based on the **length of their name** as a first parameter, if 2 people have a name with the same length, perform a **case-insensitive** compare based on the **first letter** of their name instead. The second comparator should compare them based on their **age**.

Create 2 **SortedSets** of type **Person**. The first should implement the **name comparator** and the second should implement **the age comparator**.

### Input

On the first line of input you will receive a number **N**. On each of the next **N** lines you will receive information about people in the format **“<name> <age>”**. Add the people from the input into both sets (both sets should hold all the people passed in from the input).

### Output

Print each person from the set on a new line in the same format that you have received them. Start with the set that implements the name comparator.

### Constraints

* A person’s name will be a string that contains only alphanumerical characters with length between **[1…50]** symbols.
* A person’s age will be a positive integer between **[1…100]**.
* The number of people **N** will be a positive integer between **[0…100]**.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 3  Pesho 20  Joro 100  Pencho 1 | Joro 100  Pesho 20  Pencho 1  Pencho 1  Pesho 20  Joro 100 |
| 5  Ivan 17  asen 33  Stoqn 25  Nasko 99  Joro 3 | asen 33  Ivan 17  Joro 3  Nasko 99  Stoqn 25  Joro 3  Ivan 17  Stoqn 25  asen 33  Nasko 99 |

## \*Equality Logic

Create a **class Person** holding a **name** and an **age**. A person with the same name and age should be considered the same. Override any methods needed to enforce this logic. Your class should work with both standard and hashed collections. Create a **SortedSet** and a **HashSet** of type Person.

### Input

On the first line of input you will receive a number **N**. On each of the next **N** lines you will receive information about people in the format **“<name> <age>”**. Add the people from the input into both of the sets (both sets should hold all the people passed from the input).

### Output

The output should consist of exactly two lines. On the first one, you should print the size of the tree set and on the second - the size of the hashset.

### Constraints

* A person’s name will be a string that contains only alphanumerical characters with a length between **[1…50]** symbols.
* A person’s age will be a positive integer between **[1…100]**.
* The number of people **N** will be a positive integer between **[0…100]**.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 4  Pesho 20  Peshp 20  Joro 15  Pesho 21 | 4  4 |
| 7  Ivan 17  ivan 17  Stoqn 25  Ivan 18  Ivan 17  Stopn 25  Stoqn 25 | 5  5 |

### Hint

You should override both the **Equals** and **GetHashCode** methods. You can check online for an implementation of **GetHashCode** – it doesn’t have to be perfect, but it should be good enough to produce the same hash code for objects with the same name and age, and different enough hash codes for objects with different name and/or age.