Iterators And Comparators

Problem 1. ListyIterator

Create a **generic** class "ListyIterator", it should **receive** the collection which it will iterate over, through its **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 successfully moved 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

Problem 2. 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 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 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

Problem 3. 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 to 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

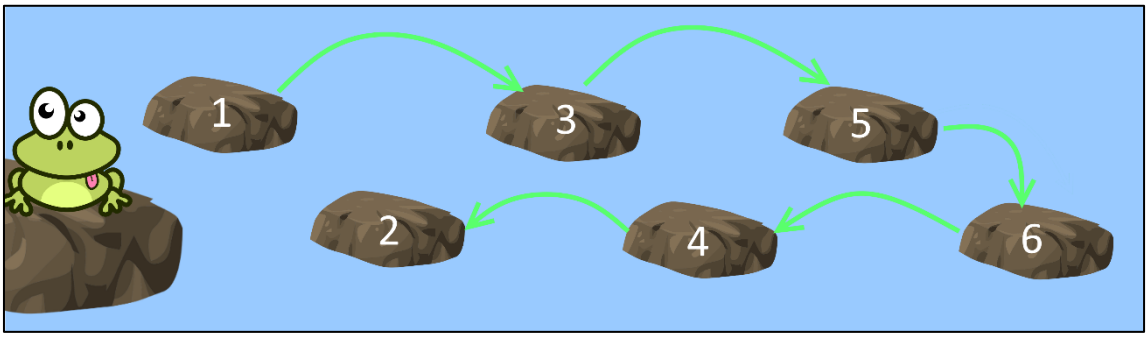
- The elements in the push command will be valid integers between **[2^{-32}…2^{32}-1]**.
- The commands will always be valid (always be either **Push, Pop** or **END**).
- If Pop command could not be executed as expected (e.g. no elements in the stack), print on the console: "**No elements**".

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

Problem 4. 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

Problem 5. Comparing Objects

There is a Comparable interface but you already know it. Your task is simple. 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 **N**th 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 a 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

Problem 6. 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()** and **Array.Sort()** 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

Foreach the sets and print each person from the set on a new line in the same format that you 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 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
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

Problem 7. *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 sets (both sets should hold all the people passed in from the input).

Output

The output should consists of exactly 2 lines. On the first 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.

Problem 8. *Pet Clinics

You are a young and ambitious owner of a Pet Clinics Holding. You ask your employees to create a program which will store all information about the pets in the database. Each **pet** should have a **name**, an **age** and a **kind**.

Your application should **support** a few **basic operations** such as **creating a pet**, **creating a clinic**, **adding a pet** to a clinic, **releasing a pet** from a clinic, **printing information** about a specific room in a clinic or printing information about all rooms in a clinic.

Clinics should have an **odd** number of rooms. Attempting to create a clinic with an **even** number of rooms should **fail** and throw an **appropriate exception**.

Accommodation Order

For example, let us take a look at a clinic with 5 rooms. The first room, where a pet will be treated is the central one (room 3). So, the order of animals entering is: the first animal goes to the central (3) room and then the next pets enter the room to the left (2) and then to the right (4). The last rooms pets can enter are room 1 and room 5. In case a room is already occupied, we skip it and go to the next room in order. Your task is to model the application and make it support some commands.

The first pet enters room 3. -> 1 2 **3** 4 5

The next pet enters room 2. -> 1 **2** 3 4 5

The third pet would enter room 4. -> 1 2 3 **4** 5

And the last two pets would be going to rooms 1 and 5. -> **1** 2 3 4 **5**

Now when we have covered adding the pets, it is time to find a way to release them. The process of releasing them is not so simple – when the **release** method is called, we start from the central room (3) and continue **to the right** (4, 5) until we find a pet or reach the last room. If we reach the last room, we start from the first (1) and again move to the right until we reach the central room (3). If a pet is found, we remove it from the collection, stop further search and return **true**, if a pet is **NOT** found, the operation returns **false**.

When a print command for a room is called, if the room contains a pet we print the pet on a single line in the format: **"<pet name> <pet age> <pet kind>"**.
Alternatively if the room is empty print **"Room empty"** instead. When a print command for a clinic is called it should print all rooms in the clinic in order of their number.

Commands

Command	Return Type	Description
`Create Pet {name} {age} {kind}`	`void`	`Creates a pet with the specified name and age.` `(true if the operation is successful and false if it isn't)`
`Create Clinic {name} {rooms}`	`void`	`Creates a Clinic with the specified name and number of rooms.` `(if the rooms are not odd, throws an exception)`

Add {pet's name} {clinic's name}	boolean	This command should add the given pet in the specified clinic. (true if the operation is successful and false if it isn't).
Release {clinic's name}	boolean	This command should release an animal from the specified clinic. (true if the operation is successful and false if it isn't).
HasEmptyRooms {clinic's name}	boolean	Returns whether the clinic has any empty rooms. (true if it has and false if it doesn't).
Print {clinic's name}	void	This command should print each room in the specified clinic, ordered by room number.
Print {clinic's name} {room}	void	Prints on a single line the content of the specified room.

Input

On the first line, you will be given an integer **N** – the number of commands you will receive.

On each of the next **N** lines you will receive a command. Commands and parameters will always be correct (**Add, Release, HasEmptyRooms** and **Print** commands will always be passed existing clinics/pets), except for the number of rooms in the **Create Clinic** command, which can be any valid integer between **1** and **101**.

Output

For each command with a **boolean** return **type** received through the input, you should **print** its **return value** on a **separate line**.

In case of a method **throwing** an **exception** (such as trying to create a **clinic** with **even number** of **rooms** or trying to **add** a **pet** that **doesn't exist**) you should catch the exceptions and instead print **"Invalid Operation!"**.

The **Print** command with a **clinic** and a **room** should print information for that **room** in the format specified above.

The **Print** command with **only** a **clinic** should print information for **each room** in the **clinic** in **order** of their **numbers**.

Constraints

- The number of commands **N** – will be a valid integer between **[1…1000]**, no need to check it explicitly.
- **Pet names**, **Clinic names**, and **kind** will be strings consisting only of alphabetical characters with length between **[1…50]** characters.
- **Pet age** will be a positive integer between **[1…100]**.
- **Clinic rooms** will be a positive integer between **[1…101]**.
- **Room number** in a **Print** command will always be between **1** and the **number of rooms** in that Clinic.

- Input will consist **only** of **correct commands** and they will **always** have the correct type of parameters.

Example

Input	Output
9 Create Pet Gosho 7 Cat Create Clinic Rezovo 4 Create Clinic Rizovo 1 HasEmptyRooms Rizovo Release Rizovo Add Gosho Rizovo HasEmptyRooms Rizovo Create Pet Sharo 2 Dog Add Sharo Rizovo	Invalid Operation! True False True False False
8 Create Pet Gosho 7 Cat Create Pet Sosho 1 Cata Create Clinic Rezovo 5 Add Gosho Rezovo Add Sosho Rezovo Print Rezovo 3 Release Rezovo Print Rezovo	True True Gosho 7 Cat True Room empty Sosho 1 Cata Room empty Room empty Room empty

Problem 9. ***Linked List Traversal

You need to write your own simplified implementation of a generic **Linked List** which implements **IEnumerable<T>**. The list should support the **Add** and **Remove** operations, should reveal the amount of elements it has with a **Count** property. The **Add** method should add the new element at the end of the collection. The **Remove** method should remove the **first occurrence** of the item starting at the beginning of the collection, if the element is succesfully removed the method **returns true**, alternatively if the element passed is not in the collection the method should **return false**. The **Count** property should return the number of elements currently in the list.

Input

On the first line of input you will receive a number **N**. On each of the next **N** lines you will receive a command in one of the following formats:

- **Add <number>** – adds a number to your linked list.
- **Remove <number>** – removes the first occurrence of the number from the linked list. If there is no such element this command leaves the collection unchanged.

Output

The output should consists of exactly 2 lines. On the first you should print the result of calling the **Count** property on the **Linked List**. On the second you should print **all elements** of the collection on a single line seperated by spaces, by calling **foreach** on the collection.

Constraints

- All numbers in the input will be valid integers between **[2^{-32}…2^{32}-1]**.
- All commands received through the input will be **valid** (will be only **Add** or **Remove**).
- The number of lines **N** will be a positive integer between **[1…500]**.

Examples

Input	Output
5 Add 7 Add -50 Remove 3 Remove 7 Add 20	2 -50 20
6 Add 13 Add 4 Add 20 Add 4 Remove 4 Add 4	4 13 20 4 4

Hint

You can use the **lab** about Linear Data Structures to help you implement your linked list. The resources should be enough as a guide for you to implement it.