Lab: Stacks and Queues

Problems for the "C# Advanced" course @ Software University.

Check your solutions in SoftUni Judge: https://judge.softuni.org/Contests/1445/Stacks-and-Queues-Lab.

I. Working with Stacks

1. Reverse a String

Create a program that:

- **Reads** an **input string**
- **Reverses** it backwards (letter by latter, from the last to the first) **using a `Stack<T>`**
- **Prints** the result back at the console

Examples

Input	Output
`I Love C#`	`#C evoL I`
`Stacks and Queues`	`seueuQ dna skcatS`

Hints

- Use a **`Stack<string>`** and the methods **`Push()`**, **`Pop()`**.
- Push all chars from the input string, then pop and print them one by one.

2. Stack Sum

Create a program that:

- **Reads** an **input of integer numbers** and **adds** them to a **stack**.
- **Reads and executes commands** until **"end"** is received.
- Process the following commands:
  - **Add <n1> <n2>**: pushes two numbers into the stack
  - **Remove <n>**: removes the n elements from the stack or does nothing if the stack holds less than **n** elements.
- **Prints** the **sum** of the remaining elements of the **stack**.

Input

- On the **first line,** you will receive **an array of integers** (space-separated).
- On the **next lines**, until the "**end**" command is given, you will receive **commands** – a **single command** and **one** or **two** numbers after **the command, depending** on what **command** you are given.
  - If the **command** is "**add**", you will **always** be given **exactly two** numbers after the command, which you need to **add** to the **stack**.
  - If the **command** is "**`remove`**", you will **always** be given **exactly one** number after the command, which represents the **count** of the numbers you need to **remove** from the **stack.** If there are **not enough elements,** skip the command.
- Commands are **case-insensitive**, which means that "**Add**", "**add**" and "**aDD**" are the same command.
- A **single space** is used as a **separator** between commands and numbers.

Output

- When the **command** "**end**" is received, you need to **print the sum** of the **remaining** elements in the **stack**.

Examples

Input	Output	Comments
1 2 3 4 adD 5 6 `REmove 3` eNd	`Sum: 6`	The stack initially holds [1, 2, 3, 4]. After the “Add 5 6” command, the stack holds [1, 2, 3, 4, 5, 6]. After the “Remove 3” command, the stack holds [1, 2, 3]. The sum of the elements [1, 2, 3] is 6.
3 5 8 4 1 9 add 19 32 remove 10 add 89 22 remove 4 remove 3 end	`Sum: 16`	The stack initially holds [3, 5, 8, 4, 1, 9]. The stack now holds [3, 5, 8, 4, 1, 9, 19, 32]. The command “Remove 10” is ignored (not enough elements). The stack now holds [3, 5, 8, 4, 1, 9, 19, 32, 89, 22]. The stack now holds [3, 5, 8, 4, 1, 9]. The stack now holds [3, 5, 8]. The sum of the elements [3, 5, 8] is 16.

Hints

- Use a **`Stack<int>`**
- Use the methods **`Push()`**, **`Pop()`**
- Commands **may** be given in **mixed case**.

3. Simple Calculator

Create a simple calculator that can **evaluate simple expressions** with only **addition** and **subtraction**. There will not be any parentheses. Numbers and operations are **space-separated**.

Solve the problem **using a `Stack`**.

Examples

Input	Output
2 + 5 + 10 - 2 - 1	14
2 - 2 + 5	5

Hints

- **Split** the input expression by space to **extract its tokens** (numbers and operations).
- **Reverse** the input tokens, then **push** them in a **Stack<string>**.
- Example:
  - Input expression: 2 + 5 + 10 - 2 - 1
  - Stack: 1 - 2 - 10 + 5 + 2
- **Pop** the last **number** (in the above example 2). It is the current result.
- **Pop** an **operation** and **number** (e. g. **+ 5**). Execute the operation. In our example: result = 2 + 5 = 7.
- **Repeat** the previous step until the stack gets empty.

4. Matching Brackets

We are given an arithmetic expression with brackets. Scan through the string and extract each sub-expression.

Print the result back at the terminal.

Examples

Input	Output

1 + (2 - (2 + 3) * 4 / (3 + 1)) * 5	`(2 + 3)`
	`(3 + 1)`
	`(2 - (2 + 3) * 4 / (3 + 1))`

(2 + 3) - (2 + 3)	`(2 + 3)` `(2 + 3)`

Hints

- Scan through the expression from its start to its end, searching for brackets.
  - If you find an **opening** bracket, **push its index** (position in the input expression) into the stack.
  - If you find a **closing** bracket **pop the topmost** element from the stack. This is the **index** of the **opening bracket**.
  - Use the **current** and the popped index to extract the sub-expression.

II. Working with Queues

5. Print Even Numbers

Create a program that:

- **Reads** an array of **integers** and **adds** them to a **queue**.
- **Prints** the **even** numbers **separated** by "**`, `**".

Examples

Input	Output
1 2 3 4 5 6	`2, 4, 6`
11 13 18 95 2 112 81 46	`18, 2, 112, 46`

Hints

- Parse the input and enqueue all the numbers in a **`Queue<int>`**.
- **Dequeue** the elements one by one and print all **even** values.

6. Supermarket

You are given a **sequence of input strings**, each staying on a separate line. Each input string holds either a customer **name**, or the command "**Paid**" or the command "**End**". Your task is to read and process the input:

- When you receive a **customer name**, add it to the queue.
- When you receive the "**`Paid`**" command, **print** the customer names from the queue (each at separate line), then empty the queue.
- When you receive the "**End**" command, print the count of the remaining customers from the queue in the format: **`"{count} people remaining."`** and stop processing the commands (see the examples below).

Examples

Input	Output

`Liam`
`Noah`
`James`
`Paid`
`Oliver`
`Lucas`
`Logan`
`Tiana`
`End`
	`Liam`
	`Noah`
	`James`
	`4 people remaining.`

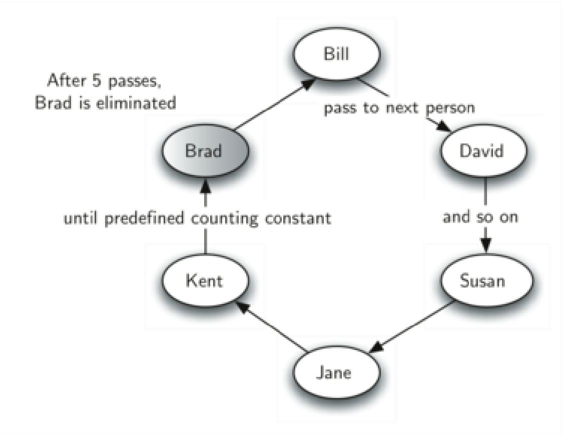
`Amelia`
`Thomas`
`Elias`
`End`
	`3 people remaining.`

Hints

Use a queue and follow the description. Just read and implement the commands.

7. Hot Potato

Hot potato is a game in which **children form a circle and start passing a hot potato**. The counting starts with the first kid. **Every nth toss the child left with the potato leaves the game**. When a kid leaves the game, it passes the potato along to its next neighbor. This continues **until there is only one kid left**.



Create a program that simulates the game of Hot Potato. **Print every kid that is removed from the circle**. In the end, **print the kid that is left last**.

Examples

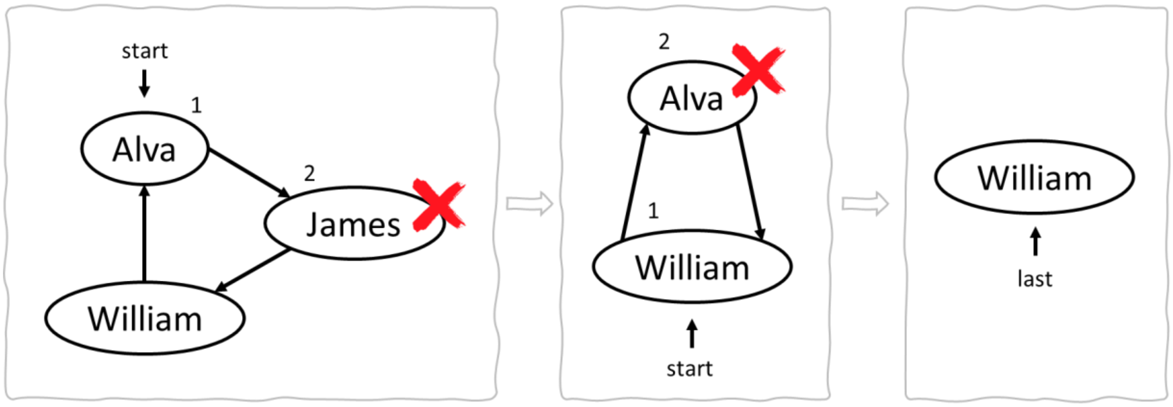
Input	Output

`Alva James William`
`2`
	`Removed James`
	`Removed Alva`
	`Last is William`

`Lucas Jacob Noah Logan Ethan`
`10`
	`Removed Ethan`
	`Removed Jacob`
	`Removed Noah`
	`Removed Lucas`
	`Last is Logan`

Carter Dylan Jack Luke Gabriel 1	Removed Carter Removed Dylan Removed Jack Removed Luke Last is Gabriel

Illustration for the first example (Alva + James + William, n=2):



Hints

- Enqueue all kids in a **Queue<string>**.
- For each round do the following:
  - (n-1) times deque an element and enqueue it again.
  - Remove an element and print it (this is the nth element).
- Repeat the above until the queue remains holding only 1 element.

8. Traffic Jam

Create a program that simulates the **queue** that forms during a **traffic jam**. During a traffic jam, only **N** cars can **pass** the crossroads when the **light goes green**. Then the program reads the **vehicles** that **arrive** one by one and **adds** them to the **queue**. When the light **goes green N** number of cars **pass** the crossroads and **for each,** a **message** "**{car} passed!**" is displayed. When the "**end**" command is given, **terminate** the program and **display** a **message** with the **total number** of cars that **passed** the crossroads.

Input

- On the **first line,** you will receive **N** – the number of cars that can pass during a green light.
- On the **next lines,** until the "**end**" command is given, you will receive **commands** – a **single string**, either a **car** or "**green**".

Output

- Every time the "**green**" command is given, **print out** a message for **every car** that **passes** the crossroads in the format "**{car} passed!**".
- When the "**end**" command is given, **print out** a message in the format "**{number of cars} cars passed the crossroads.**".

Examples

Input	Output
4 Hummer H2	Hummer H2 passed! Audi passed!

Audi Lada Tesla Renault Trabant Mercedes MAN Truck green green Tesla Renault Trabant end	Lada passed! Tesla passed! Renault passed! Trabant passed! Mercedes passed! MAN Truck passed! 8 cars passed the crossroads.
3 Enzo's car Jade's car Mercedes CLS Audi green BMW X5 green end	Enzo's car passed! Jade's car passed! Mercedes CLS passed! Audi passed! BMW X5 passed! 5 cars passed the crossroads.