

# Exercises: Stacks and Queues

This document defines the exercises for ["Java Advanced" course @ Software University](#). Please submit your solutions (source code) of all below described problems in [Judge](#).

## 1. Reverse Numbers with a Stack

Write a program that reads **N** integers from the console and **reverses them using a stack**. Use the `ArrayDeque<Integer>` class. Just put the input numbers in the stack and pop them. Examples:

### Examples

Input	Output
1 2 3 4 5	5 4 3 2 1
1	1

## 2. Basic Stack Operations

You will be given an integer **N** representing the **number of elements to push onto the stack**, an integer **S** representing the **number of elements to pop from the stack** and finally an integer **X**, an element **that you should check whether is present in the stack**. If it is, print **true** on the console. If it's not, print the smallest element currently present in the stack.

### Input

- On the first line, you will be given **N**, **S** and **X** separated by a single space.
- On the next line, you will be given a line of numbers **separated by one or more white spaces**.

### Output

- On a single line print either **true** if **X** is present in the stack otherwise **print the smallest** element in the stack.
- If the stack is empty print 0.

### Examples

Input	Output	Comments
5 2 13 1 13 45 32 4	true	We have to <b>push 5</b> elements. Then we <b>pop 2</b> of them. Finally, we have to check whether 13 is present in the stack. Since it is we print <b>true</b> .
4 1 666 420 69 13 666	13	Pop one element (666) and then check if 666 is present in the stack. It's not, so print the smallest element (13)

## 3. Maximum Element

You have an empty sequence, and you will be given **N** commands. Each command is one of the following types:

- "1 X" - **Push** the element **X** into the stack.
- "2" - **Delete** the element present at the top of the stack.
- "3" - **Print** the maximum element in the stack.

## Input

- The first line of input contains an integer **N**, where  $1 \leq N \leq 10^5$
- The next **N** lines contain commands. All commands will be valid and in the format described
- The element **X** will be in range  $1 \leq X \leq 10^9$
- The **type of the command** will be in range  $1 \leq \text{Type} \leq 3$

## Output

- For each command of **type "3"**, **print the maximum element** in the stack on a new line.

## Examples

Input	Output	Comments
9	26	9 commands
1 97	91	Push 97
2		Pop an element
1 20		Push 20
2		Pop an element
1 26		Push 26
1 20		Push 20
3		Print the maximum element (26)
1 91		Push 91
3		Print the maximum element (91)

## 4. Basic Queue Operations

You will be given an integer **N** representing the **number of elements to enqueue** (add), an integer **S** representing the **number of elements to dequeue** (remove/poll) from the queue and finally an integer **X**, an element that you should **check whether is present in the queue**. If it is print **true** on the console, if it's not **print the smallest element** currently present in the queue.

## Examples

Input	Output	Comments
5 2 32 1 13 45 32 4	true	We have to <b>push 5</b> elements. Then we <b>pop 2</b> of them. Finally, we have to check whether 13 is present in the stack. Since it is we print <b>true</b> .
4 1 666 666 69 13 420	13	
3 3 90 90 90 90	0	

## 5. Robotics

Somewhere in the future, there is a robotics factory. The current project is assembly line robots.

Each robot has a **processing time**, the time it needs to process a product. When a **robot is free** it should **take a product for processing** and log his name, product and processing start time.

Each robot **processes a product coming from the assembly line**. A **product is coming** from the line **each second** (so the first product should appear at [start time + 1 second]). If a product passes the line and **there is not a free robot** to take it, it should be **queued at the end of the line again**.

The robots are **standing on the line in the order of their appearance**.

### Input

- On the first line, you will get the names of the robots and their processing times in format "**robotName-processTime;robotName-processTime;robotName-processTime**"
- On the second line, you will get the starting time in format "**hh:mm:ss**"
- Next, until the "**End**" command, you will get a product on each line.

### Examples

Input	Output
ROB-15;SS2-10;NX8000-3 8:00:00 detail glass wood apple End	ROB - detail [08:00:01] SS2 - glass [08:00:02] NX8000 - wood [08:00:03] NX8000 - apple [08:00:06]
ROB-60 7:59:59 detail glass wood sock End	ROB - detail [08:00:00] ROB - sock [08:01:00] ROB - wood [08:02:00] ROB - glass [08:03:00]

## 6. Balanced Parentheses

Given a sequence consisting of parentheses, determine **whether the expression is balanced**. A sequence of parentheses is **balanced** if every open parenthesis can be paired uniquely with a closed parenthesis that occurs after the former. Also, **the interval between them must be balanced**.

You will be given three types of parentheses: (, {, and [.

{(())} - This is a balanced parenthesis.

{[(())]} - This is not a balanced parenthesis.

## Input

- Each input consists of a single line, the sequence of parentheses.
- $1 \leq \text{Length of sequence} \leq 1000$
- Each character of the sequence will be one of the following: {, }, (, ), [, ].

## Output

- For each test case, print on a new line "YES" if the parentheses are balanced. Otherwise, print "NO".

## Examples

Input	Output
{[()]}	YES
{[(())]}	NO
{{[[((()))]]}}	YES

## 7. Recursive Fibonacci

Each member of the **Fibonacci sequence** is calculated from the **sum of the two previous members**. The first two elements are 1, 1. Therefore the sequence goes as 1, 1, 2, 3, 5, 8, 13, 21, 34...

The following sequence can be generated with an array, but that's easy, so **your task is to implement it recursively**.

If the function **getFibonacci(n)** returns the  $n^{\text{th}}$  Fibonacci number, we can express it using **getFibonacci(n) = getFibonacci(n-1) + getFibonacci(n-2)**.

However, this will never end and in a few seconds a Stack Overflow Exception is thrown. In order for the recursion to stop it has to have a "bottom". The bottom of the recursion is getFibonacci(1), and should return 1. The same goes for getFibonacci(0).

## Input

- On the only line in the input the user should enter the wanted Fibonacci number N where  $1 \leq N \leq 49$

## Output

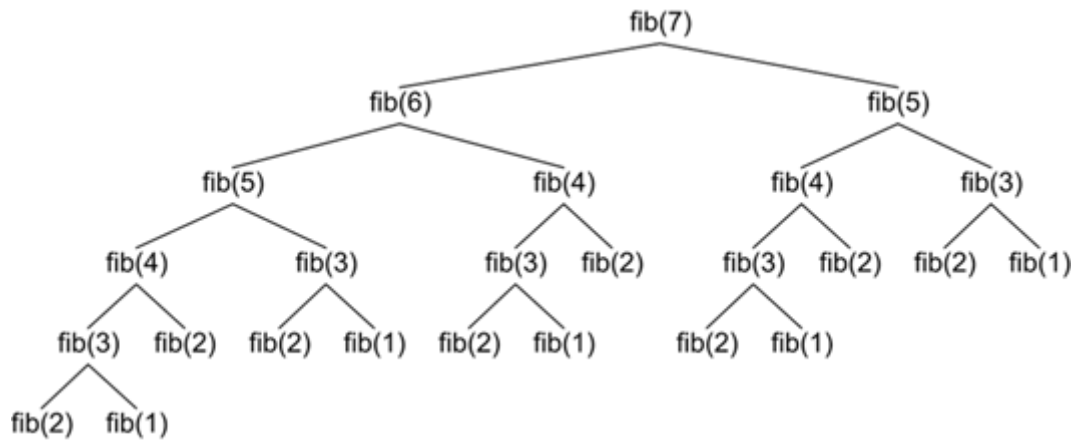
- The output should be the  $n^{\text{th}}$  Fibonacci number counting from 0

## Examples

Input	Output
5	8
10	89
21	17711

## Hint

For the  $n^{\text{th}}$  Fibonacci number, we calculate the  $N-1^{\text{st}}$  and the  $N-2^{\text{nd}}$  number, but for the calculation of  $N-1^{\text{st}}$  number we calculate the  $N-1-1^{\text{st}}$  ( $N-2^{\text{nd}}$ ) and the  $N-1-2^{\text{nd}}$  number, so we have a lot of repeated calculations.



If you want to figure out how to skip those unnecessary calculations, you can search for a technique called [memoization](#).

## 8. \*Simple Text Editor

You are given an empty text. Your task is to implement **4 types of commands** related to manipulating the text:

- **"1 [string]" - appends** [string] to the end of the text
- **"2 [count]" - erases** the last [count] elements from the text
- **"3 [index]" - returns** the element at position [index] from the text
- **"4" - undoes** the last not-undone command of type 1 or 2 and returns the text to the state before that operation

### Input

- The first line contains **N**, the number of operations, where  $1 \leq N \leq 105$
- Each of the following **N** lines contains the name of the operation, followed by the command argument, if any, separated by space in the following format **"command argument"**.
- **The length of the text** will not exceed **1000000**
- All input characters are **English letters**
- It is **guaranteed** that the sequence of **input operation** is possible to perform

### Output

- For each operation of type **"3"** print a **single line with the returned character of that operation**.

### Examples

Input	Output	Comments
8	c	There are <b>8 operations</b> . Initially, the <b>text is empty</b> .
1 abc	y	Append "abc"
3 3	a	Print third character
2 3		Erase 3 characters
1 xy		Append "xy"
3 2		Print second character
4		Undo last command - text is now ""
4		Undo last command - text is now "abc"
3 1		

## 9. \*Infix to Postfix

Mathematical expressions are **written in an infix notations**, for example " $5 / ( 3 + 2 )$ ". However, this kind of notation is **not efficient for computer processing**, as you first need to evaluate the expression inside the brackets, so there is a lot of back and forth movement. A more suitable approach is to **convert it in the so-called postfix notations** (also called [Reverse Polish Notation](#)), in which the **expression is evaluated from left to right**, for example " $3\ 2\ +\ 5\ /\$ ".

Implement an **algorithm that converts** the mathematical expression **from infix notation into a postfix notation**. Use the famous [Shunting-yard algorithm](#).

### Input

- You will **receive an expression on a single line, consisting of tokens**
- Tokens could be numbers 0-9, variables a-z, operators +, -, \*, / and brackets ( or )
- Each token is **separated by exactly one space**

### Output

- The **output should be on a single line, consisting of tokens, separated by exactly one space.**

### Examples

Input	Output
$5 / ( 3 + 2 )$	$5\ 3\ 2\ +\ /\$
$1 + 2 + 3$	$1\ 2\ +\ 3\ +$
$7 + 13 / ( 12 - 4 )$	$7\ 13\ 12\ 4\ -\ /\ +$
$( 3 + x ) - y$	$3\ x\ +\ y\ -$

## 10. \*\*Poisonous Plants

You are given **N** plants in a garden. Each of these plants has been added with some amount of pesticide. After each day, if any plant has **more pesticide** than the plant at **its left**, being weaker (more GMO) than the left one, **it dies**. You are given the initial values of the pesticide and position of each plant. Print the number of days **after** which no plant dies, i.e. the time after which there are no plants with more pesticide content than the plant to their left.

### Input

- The input consists of an integer **N** representing the number of plants.
- The next **single line** consists of **N** integers, where every integer represents the position and amount of pesticides of each plant.  $1 \leq N \leq 100000$
- Pesticides amount on a plant is between 0 and 1000000000

### Output

- Output a single value equal to the number of days after which no plants die

## Examples

Input	Output	Comments
7 6 5 8 4 7 10 9	2	<p>Initially all plants are alive.</p> <p>Plants = {(6, 1), (5, 2), (8, 3), (4, 4), (7, 5), (10, 6), (9, 7)}</p> <p>Plants[k] = (i, j) =&gt; j<sup>th</sup> plant has pesticide amount = i.</p> <p>After the 1<sup>st</sup> day, 4 plants remain as plants 3, 5, and 6 die.</p> <p>Plants = {(6, 1), (5, 2), (4, 4), (9, 7)}</p> <p>After the 2<sup>nd</sup> day, 3 plants survive as plant 7 dies. Plants = {(6, 1), (5, 2), (4, 4)}</p> <p>After the 3<sup>rd</sup> day, 3 plants survive and no more plants die.</p> <p>Plants = {(6, 1), (5, 2), (4, 4)}</p> <p>After the 2<sup>nd</sup> day the plants stop dying.</p>