# Exercises: Stacks and Queues

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

You can check your solutions here: <https://judge.softuni.bg/Contests/184/Stacks-and-Queues-Exercise>.

## Reverse Numbers with a Stack

Write a program that reads **N integers** from the console and **reverses them using a stack**. Use the **Stack<int>** 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 |

## Basic Stack Operations

Play around with a stack. 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 look for in the stack. If it’s found, print “**true**”on the console. If it isn’t, print the **smallest** element currently present in the stack.

### Input Format:

* 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 **N** number of integers

### Output Format:

* 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 **push 5** elements. Then we **pop 2** of them. Finally, we have to check whether 13 is present in the stack. Since it is we print **true**. |
| 4 1 666  420 69 13 666 | 13 |  |

## Maximum Element

You have an empty sequence, and you will be given **N** queries. Each query is one of these three 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 Format:

* The first line of input contains an integer, **N**
* The next **N** lines each contain an above-mentioned query. *(It is guaranteed that each query is valid.)*

### Output Format:

* For each type 3 query, print the **maximum** element in the stack on a new line

### Constraints:

* 1 ≤ N ≤ 105
* 1 ≤ x ≤ 109
* 1 ≤ type ≤ 3

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 9  1 97  2  1 20  2  1 26  1 20  3  1 91  3 | 26  91 |

## Basic Queue Operations

Play around with a queue. 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**) from the queue and finally an integer **X**, an element that you should look for in the **queue**. If it is, print **true** on the console. If it’s not print the **smallest** **element** currently present in the queue. If there are **no** **elements** in the sequence, print **0** on the console.

### Examples

|  |  |  |
| --- | --- | --- |
| **Input** | **Output** | **Comments** |
| 5 2 32  1 13 45 32 4 | true | We have to **enqueue 5** elements. Then we **dequeue** **2** of them. Finally, we have to check whether 13 is present in the queue. Since it is we print **true**. |
| 4 1 666  666 69 13 420 | 13 |  |
| 3 3 90  90 90 90 | 0 |  |

## Calculate Sequence with Queue

We are given the following sequence of numbers:

* S1 = N
* S2 = S1 + 1
* S3 = 2\*S1 + 1
* S4 = S1 + 2
* S5 = S2 + 1
* S6 = 2\*S2 + 1
* S7 = S2 + 2
* S8 = S3 + 1
* …

Using the **Queue<T>** class, write a program to print its first 50 members for given N.

### Constraints:

* -4000000000 ≤ N ≤ 2000000000

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 2 | 2 3 5 4 4 7 5 6 11 7 5 9 6 … |
| -1 | -1 0 -1 1 1 1 2 … |
| 1000 | 1000 1001 2001 1002 1002 2003 1003 … |

## Truck Tour

Suppose there is a circle. There are **N** petrol pumps on that circle. Petrol pumps are numbered 0 to (N−1) (both inclusive). You have **two pieces of information** corresponding to each of the petrol pump: (1) the **amount of petrol** that particular petrol pump will give, and (2) the **distance from that petrol pump** to the next petrol pump.

Initially, you have a tank of infinite capacity carrying no petrol. You can start the tour at **any** of the petrol pumps. Calculate the **first point** from where the truck will be able to complete the circle. Consider that the truck will stop at **each of the petrol pumps**. The truck will move one kilometer for each liter of the petrol.

### Input Format:

* The first line will contain the value of **N**
* The next **N** lines will contain a pair of integers each, i.e. the amount of petrol that petrol pump will give and the distance between that petrol pump and the next petrol pump

### Output Format:

* An integer which will be the smallest index of the petrol pump from which we can start the tour

### Constraints:

* 1 ≤ N ≤ 1000001
* 1 ≤ Amount of petrol, Distance ≤ 1000000000

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 3  1 5  10 3  3 4 | 1 |

## 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 Format:

* Each input consists of a single line, the sequence of parentheses.

### Constraints:

* 1 ≤ lens ≤ 1000, where lens is the length of the sequence.
* Each character of the sequence will be one of {, }, (, ), [, ].

### Output Format:

* For each test case, print on a new line "YES" if the parentheses are balanced.   
  Otherwise, print "NO". Do not print the quotes.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| {[()]} | YES |
| {[(])} | NO |
| {{[[(())]]}} | YES |

## Stack Fibonacci

Calculate the Fibonacci sequence **using a stack**. Set the Fibonacci sequence to start from 0, i.e. 0, 1, 1, 2, 3, 5, 8… and so on. First **push** 0 and 1 and then use **popping,** **peeking** and **pushing** to generate every consecutive number.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 7 | 13 |
| 15 | 610 |
| 33 | 3524578 |

## Simple Text Editor

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

* 1 someString - **appends** someString 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 / 2* and returns the text to the state before that operation

### Input format:

* The first line contains ***n***, the number of operations.
* 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 ***CommandName Argument***.

### Output Format:

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

### Constraints:

* 1 ≤ N ≤ 105
* 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.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 8  1 abc  3 3  2 3  1 xy  3 2  4  4  3 1 | c  y  a |

### Explanation

* There are 8 operations. Initially, the text is empty.
* In the first operation, we append **abc** to the text.
* Then, we print its 3rd character,which is **c** at this point.
* Next, we erase its last 3 characters, **abc**.
* After that, we append **xy** to the text.
* The text becomes **xy** after these previous two modifications.
* Then, we are asked to return the 2nd character of the text, which is **y**.
* After that, we have to undo the last update to the text, so it becomes empty.
* The next operation asks us to undo the update before that, so the text becomes **abc** again.
* Finally, we are asked to print its 1st character, which is **a** at this point.

## 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 amount of pesticide and the 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 Format:

* 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 the amount of pesticides of each plant

### Output Format:

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

### Constraints:

* 1 ≤ N ≤ 100000
* Pesticides amount on a plant is between 0 and 1000000000

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 7  6 5 8 4 7 10 9 | 2 |

### Explanation

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