# Problem A - Quebrar Um Protocolo

The ONI (National Internet Organization, or ONI in Portuguese) recruited you to test a new cryptographic protocol created by them. The protocol consists of:

- a *public key* $\boldsymbol{A}$, which is a sequence of $\boldsymbol{N}$ integers,
- and two *private keys* $\boldsymbol{B}$ and $\boldsymbol{C}$, which are two sequences of $\boldsymbol{N}$ integers such that $\boldsymbol{A}[i] = \boldsymbol{B}[i] + \boldsymbol{C}[i]$ for all $1 \leq i \leq N$.


Everyone has access to $\boldsymbol{A}$, which is used to encrypt messages. To decrypt messages, access to both sequences $\boldsymbol{B}$ and $\boldsymbol{C}$ is required. In addition to the element-wise sums forming the key $\boldsymbol{A}$, the keys $\boldsymbol{B}$ and $\boldsymbol{C}$ must also adhere to a certain set of properties. The ONI wants you to analyze the security of some possibilities for these properties. That is, given $\boldsymbol{A}$, is it easy to find keys $\boldsymbol{B}$ and $\boldsymbol{C}$ that allow breaking the cryptographic protocol?

## Part I

The first property that ONI would like you to try to satisfy is the following: for every element $\boldsymbol{B}[i]$ of $\boldsymbol{B}$ and $\boldsymbol{C}[j]$ of $\boldsymbol{C}$, we have $\boldsymbol{B}[i] > \boldsymbol{C}[j]$. That is, all elements of $\boldsymbol{B}$ must be greater than all elements of $\boldsymbol{C}$.

Given a sequence of $\boldsymbol{N}$ integers $\boldsymbol{A}$, find two sequences of $\boldsymbol{N}$ integers $\boldsymbol{B}$ and $\boldsymbol{C}$ such that the element-wise sums coincide with the elements of $\boldsymbol{A}$ and such that all elements of $\boldsymbol{B}$ are greater than all elements of $\boldsymbol{C}$.

### Example

If $\boldsymbol{N} = 6$ and $\boldsymbol{A} = \{0, 7, -3, 2, 2, -100\}$, one possibility for the keys $\boldsymbol{B}$ and $\boldsymbol{C}$ could be, for example, $\boldsymbol{B} = \{10, 6, 3, 2, 8, 15\}$ and $\boldsymbol{C} = \{-10, 1, -6, 0, -6, -115\}$.

### Constraints

The following limits are guaranteed in all test cases of this part that will be placed to the program:

| | |
|---|---|
| $1 \leq \boldsymbol{N} \leq 10^5$ | Length of the key |
| $-10^4 \leq \boldsymbol{A}[i] \leq 10^4$ | Size of the integers in the public key |

Additionally, the following constraint is required for the private keys found:

$-10^9 \leq \boldsymbol{B}[\boldsymbol{i}] \leq 10^9$ Size of the integers in the private key $\boldsymbol{B}$
$-10^9 \leq \boldsymbol{C}[\boldsymbol{i}] \leq 10^9$ Size of the integers in the private key $\boldsymbol{C}$

**Note**: If the output of your program contains values that do not respect these intervals, the program will obtain a *Wrong Answer* result.

The test cases of this part of the problem are organized into a single group without any additional restrictions:

| Subtask | Points | Additional Constraints |
|---|---|---|
| 1 | 35 | No additional restrictions |

# Part II

After several vulnerabilities were found in the previous protocol, ONI asked you to try to respect a new property, which they believe is much safer: for every $i > 1$ we have $\boldsymbol{B}[i] > \boldsymbol{B}[i-1]$ and $\boldsymbol{C}[i] < \boldsymbol{C}[i-1]$. In other words, the elements of the private key $\boldsymbol{B}$ must be in strictly increasing order and the elements of the private key $\boldsymbol{C}$ must be in strictly decreasing order.

Given a sequence of integers $\boldsymbol{A}$, find two sequences $\boldsymbol{B}$ and $\boldsymbol{C}$ such that the element-wise sums coincide with the elements of $\boldsymbol{A}$ and such that the elements of $\boldsymbol{B}$ are in strictly increasing order and the elements of $\boldsymbol{C}$ are in strictly decreasing order.

## Example

If $\boldsymbol{N} = 6$ and $\boldsymbol{A} = \{0, 7, 3, 2, 2, -100\}$, one possibility for the keys $\boldsymbol{B}$ and $\boldsymbol{C}$ could be, for example, $\boldsymbol{B} = \{-5, 3, 4, 6, 22, 50\}$ and $\boldsymbol{C} = \{5, 4, -1, -4, -20, -150\}$.

## Constraints

The following limits are guaranteed in all test cases of this part that will be placed to the program:

$1 \leq \boldsymbol{N} \leq 10^5$ Length of the key
$-10^4 \leq \boldsymbol{A}[i] \leq 10^4$ Size of the integers in the public key

Additionally, the following constraint is required for the private keys found:

$-10^9 \leq \boldsymbol{B}[i] \leq 10^9$ Size of the integers in the private key $\boldsymbol{B}$
$-10^9 \leq \boldsymbol{C}[i] \leq 10^9$ Size of the integers in the private key $\boldsymbol{C}$

The test cases of this part of the problem are organized into a single group without any additional restrictions:

| Subtask | Points | Additional Constraints |
|---|---|---|
| 2 | 15 | $\boldsymbol{A}$ is a constant sequence (all elements are the same) |
| 3 | 15 | $\boldsymbol{A}$ is a strictly increasing sequence |
| 4 | 35 | No additional restrictions |

## Summary of Subtasks

The test cases of the problem are organized into four groups with different additional restrictions:

| Subtask | Points | Part | Additional Constraints |
|---|---|---|---|
| 1 | 35 | Part I | No additional restrictions |
| 2 | 15 | Part II | $\boldsymbol{A}$ is a constant sequence (all elements are the same) |
| 3 | 15 | Part II | $\boldsymbol{A}$ is a strictly increasing sequence |
| 4 | 35 | Part II | No additional restrictions |

## Input Format

The first line contains an integer $\boldsymbol{P}$, corresponding to the part that the test case represents, 1 for part I and 2 for part II.

The second line contains an integer $\boldsymbol{N}$, which indicates the length of the public key $\boldsymbol{A}$. Finally, there is one last line, containing $\boldsymbol{N}$ integers separated by spaces, which corresponds to the values of $\boldsymbol{A}[1], \boldsymbol{A}[2], \ldots, \boldsymbol{A}[\boldsymbol{N}]$.

## Output Format

For each test case, print two lines of $\boldsymbol{N}$ integers, the first containing the $\boldsymbol{N}$ elements, in order, of the found private key $\boldsymbol{B}$, and the second containing the $\boldsymbol{N}$ elements, in order, of the found private key $\boldsymbol{C}$.

## Example 1 Input

```
1
6
0 7 -3 2 2 -100
```

## Example 1 Output

```
10 6 3 2 8 15
-10 1 -6 0 -6 -115
```

## Example 1 Description

This example corresponds to the example from Part I mentioned in the statement.

## Example 2 Input

```
2
6
0 7 3 2 2 -100
```

## Example 2 Output

```
-5 3 4 6 22 50
5 4 -1 -4 -20 -150
```

## Example 2 Description

This example corresponds to the example from Part II mentioned in the statement.

## Example 3 Input

```
2
8
0 0 0 0 0 0 0 0
```

## Example 3 Output

```
-4 -3 -1 0 1 2 3 8
4 3 1 0 -1 -2 -3 -8
```

## Example 3 Description

This example corresponds to the first group of Part II.

## Example 4 Input

```
2
8
1 2 3 4 5 6 7 8
```

## Example 4 Output

```
-4 -1 1 4 6 8 11 15
5 3 2 0 -1 -2 -4 -7
```

## Example 4 Description

This example corresponds to the second group of Part II.