

# 1 Two Missing Numbers

## Description

*This problem is similar to the missing number problem you saw before.*

You are given a natural number  $N$  where  $3 \leq N \leq 100$ . Then you are also given  $N$  distinct natural numbers ranged between 1 and  $N + 2$ , inclusive. You want to find the two missing numbers.

## Input Format

You are first given  $N$ , and then you are given  $N$  numbers as described above.

## Output Format

You output the two missing numbers in order.

## Sample Input 1

```
5
5 7 1 4 2
```

## Sample Output 1

```
3 6
```

## Sample Input 2

```
8
1 2 3 4 7 8 9 10
```

## Sample Output 2

```
5 6
```

## 2 Caesar Cipher

### Description

*From Wikipedia*

In cryptography, a Caesar cipher is one of the simplest known encryption techniques. It is a type of substitution cipher in which each letter in the plain-text is replaced by a letter *some fixed number of positions* down the alphabet. For example, with a shift of 3, A would be replaced by D, B would become E, and so on. The method is named after Julius Caesar, who used it to communicate with his generals.

The transformation can be represented by aligning two alphabets; the cipher alphabet is the plain alphabet rotated left or right by some number of positions. For instance, here is a Caesar cipher using a left rotation of three places (the shift parameter, here 3, is used as the key):

Plain:     ABCDEFGHIJKLMNOPQRSTUVWXYZ  
Cipher:    DEFGHIJKLMNOPQRSTUVWXYZABC

When encrypting, a person looks up each letter of the message in the "plain" line and writes down the corresponding letter in the "cipher" line. Deciphering is done in reverse.

Ciphertext: WKH TXLFN EURZQ IRA MXPSV RYHU WKH ODCB GRJ  
Plaintext:  the quick brown fox jumps over the lazy dog

### Input Format

You are given a string which may be a cipher-text or plain-text. The given string consists only of upper-case alphabets. Then, you are given an integer that denotes the shift that was used in encryption or should be used in decryption. This integer ranges between 1 and 25, inclusive.

### Output Format

You first output the encrypted string using the given shift. Next, you output the decrypted string using the given shift.

### Sample Input 1

GRJ  
3

### Sample Output 1

JUM  
DOG

## Sample Input 2

ABCDE

1

## Sample Output 2

BCDEF

ZABCD

## 3 Fibonacci Numbers

### Description

In Mathematics, the Fibonacci numbers are defined as follows:

$$F_n = F_{n-1} + F_{n-2}$$

with seed values  $F_0 = 0$  and  $F_1 = 1$ .

Given some number  $n$ , you want to compute the value of  $F_n$ .

### Input Format

You are given an integer  $n$  where  $0 \leq n \leq 1,000$ .

### Output Format

Output the value of  $F_n$ . Since  $F_n$  could become really large, you should output  $F_n$  modulo 100,007 (that is the remainder of  $F_n$  divided by 100,007).

### Sample Input 1

5

### Sample Output 1

5

### Sample Input 2

12

### Sample Output 2

144

## 4 Flower Shop

### Description

You are the owner of a really big flower shop that delivers flowers to customers. On a particular day, you decided to have the following promotional event.

You ask  $N$  customers to write down the highest price they are willing to pay, provided that you deliver the most beautiful flower bouquet in time. After collecting the  $N$  numbers (the prices), you will decide the border line price  $p$  such that any customer who is willing to pay  $p$  or higher will pay  $p$  dollars and receive the bouquet, but all other customers who are willing to pay strictly less than  $p$  will NOT pay and will NOT receive any bouquets.

As a businessman, you want to maximize profit by choosing the optimal value  $p$ . You want to write a program that finds such  $p$  for you.

### Input Format

You are first given the number of customers,  $N$  where  $2 \leq N \leq 20$ . Then, you are given  $N$  natural numbers  $(m_1, m_2, \dots, m_N)$  where  $m_i$  represents the maximum amount of money that customer  $i$  is willing to pay where  $1 \leq i \leq N$ . You can assume that  $1 \leq m_i \leq 100$  for all  $m_i$  where  $1 \leq i \leq N$ .

### Output Format

You first output the optimal price  $p$ , and then output your maximized profit. If there are multiple  $p$  values that maximize your profit, you may output any such  $p$ .

### Sample Input 1

```
5
2 3 2 3 3
```

### Sample Output 1

```
2 10
```

### Note 1

There is no point for you to set  $p > 3$  as your profit will be zero. If you set  $2 < p \leq 3$ , then you can only collect money from customer 2, 4, and 5, which makes your profit equal to  $3p$  dollars; obviously, you will set  $p = 3$  in this case to make 9 dollars. If you set  $p = 2$ , you will collect 2 dollars from all five customers to obtain 10 dollars of profit (the optimal solution). If you set  $p < 2$ , you will collect  $p$  dollars from all customers, but it will always be less than 10 dollars.

Hence, you print 210 to denote that you chose the price to be 2 and your maximized profit was 10.

### **Sample Input 2**

```
5
100 100 10 10 10
```

### **Sample Output 2**

```
100 200
```