# 2013
# Canadian Computing Competition
# Senior Division

Tsinghua University

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# Problem S1: The Most Frequent Number

Time limit: 1 s
Memory limit: 1 GB

## Problem Description

Given $n$ positive integers, you are asked to find out the number with the greatest number of occurrence. In case of a tie, please output the smallest such number.

## Input Specification

The first line has one positive integer $n$ ($1 \leq n \leq 1\,000$), indicating the number of the elements.

The second line consists of $n$ integers $s_1, s_2, \ldots, s_n$ ($1 \leq s_i \leq 10\,000$, for $1 \leq i \leq n$). Adjacent numbers are separated by spaces.

## Output Specification

You should output the most frequent element among those $n$ numbers.

## Input Sample

```
6
10 1 10 20 30 20
```

## Output for Input Sample

```
10
```

# Problem S2: Median of Medians

Time limit: 1 s
Memory limit: 1 GB

## Problem Description

The median of $2n+1$ numbers is the $(n+1)$-th largest number amoung them. The median if $2n$ numbers is the average between the $n-$th largest number and the $(n+1)$-th largest number. For example, the median of $1, 3, 7$ is 3, while the median of $1, 2, 5, 9$ is 3.5.

You are given $n$ integers. You can divide them into any number of subsets of any size. You then calculate the median of the medians of each subset. For example, if you divide $1, 2, 9$ into two subsets $1, 9$ and 2, then the medians of these subsets are 5 and 2 respectively. Therefore, the median of medians is 3.5.

The question is to find out the smallest value and the largest value of the median of medians.

## Input Specification

The first line consists of one integer $n$ ($1 \leq n \leq 1\,000$).

The second line consists of $n$ integers $a_1, a_2, a_3, \ldots, a_n$ ($0 \leq a_i \leq 1\,000\,000$, for $1 \leq i \leq n$), separated by spaces.

## Output Specification

The output should contain two numbers, that is, the smallest value and the largest value of the median of medians. Round the numbers to 2 digits.

## Input Sample

```
4
2 1 3 1
```

## Output for Input Sample

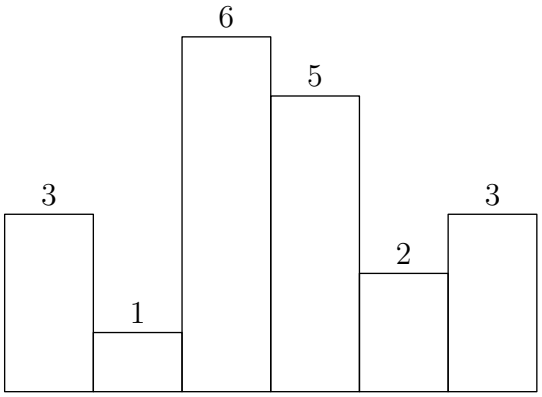
```
1.00 2.00
```

# Problem S3: Largest Rectangle

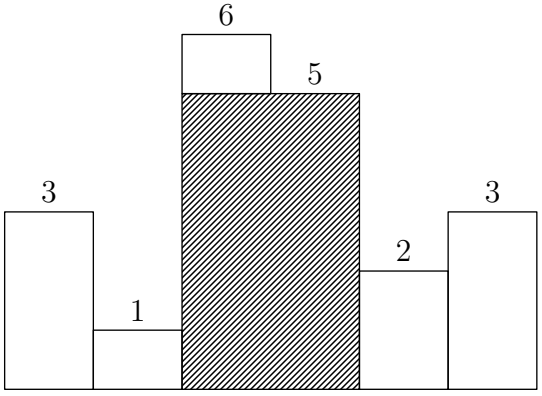
Time limit: 1 s
Memory limit: 1 GB

## Problem Description

There are $n$ rectagles placed adjacent to each other on a horizontal line. The width of each rectangle is 1, and the height of the $i$-th rectangle is $h_i$. The $n$ rectangles forms a histogram. For example, in the following figure, the height of six rectanlges are $3, 1, 6, 5, 2, 3$, respectively.




Your task is to find a largest rectangle inside such a histogram, whose sides are parallel with the x-axis or the y-axis of the plane. For the example above, the largest area of such a rectangle is 10, which is illustrated below.



## Input Specification

The first line contains only one number $n$, the number of rectangles ($1 \leq n \leq 1\,000$).

The second line consists of $n$ integers, $h_1, h_2, \ldots, h_n$, separated by spaces ($1 \leq h_i \leq 10\,000$). $h_i$ is the height of the $i$-th rectangle.

## Output Specification

The output contains only one line containing the area of the largest rectangle inside the histogram.

## Input Sample

```
6
3 1 6 5 2 3
```

## Output for Input Sample

```
10
```

# Problem S4: Interesting Numbers

Time limit: 1 s
Memory limit: 1 GB

## Problem Description

We call a number *interesting*, if and only if:

1. Its digits consists of only 0, 1, 2 and 3, and all these digits occurred at least once.

2. Inside this number, all 0s occur before any 1s, and all 2s occur before any 3s.

Therefore, the smallest interesting number according to our definition is 2013. There are two more interseting number of 4 digits: 2031 and 2301.

Your task is to calculate the number of interesting numbers of exactly $n$ digits. As the answer might be very large, you only need to output the answer modulo 1 000 000 007.

## Input Specification

The input has one line consisting of one positive integer $n$ ($4 \leq n \leq 1000$).

## Output Specification

The output has just one line, containing the number of interesting numbers of exactly $n$ digits, modulo 1 000 000 007.

## Input Sample

```
4
```

## Output for Input Sample

```
3
```

# Problem S5: I'm stuck!

Time limit: 2 s
Memory limit: 1 GB

## Problem Description

In an old game, you control a little man running on the map, eventually moving to a destination. Sadly, sometimes you suddenly realize that you have moved to a place that you would never reach the destination afterwards. Therefore, given the current state of the game, you want to know whether you can move to the destination from your current location. If you can, then you need to find out the number of cells that you can reach from your current location, but from which you cannot reach the destination.

The map is described as an array of single-character cells. Your are currently at the cell denoted by '`S`'. The destination is the cell denoted by '`T`'. '`S`' and '`T`' are otherwise the same as '`+`'.

You can only move to an adjacent cell in one step.

1. From a cell denoted by '`.`', you may only move down.
2. From a cell denoted by '`|`', you may either move up or down.
3. From a cell denoted by '`-`', you may either move to your left, or move to your right.
4. From a cell denoted by '`+`', you may move to any of the four directions.

Furthermore, you may never move outside the map, nor move to a cell denoted by '`#`'.

## Input Specification

The first line consists of two integers, $R$ and $C$, denoting the number of rows and columns of the map, respectively ($1 \leq R, C \leq 50$). Each of the following $R$ lines consists of $C$ characters. They represent the map cells. There will be exactly one '`S`' and one '`T`' in the map.

## Output Specification

If you can not reach the destination from the current position at all, output "`I'm stuck!`" (without the quotation marks). Otherwise, output the number of cells that you can reach from your current location, but from which you can not reach the destination.

## Input Sample

```
5 5
--+-+
..|#.
..|##
S-+-T
####.
```

## Output for Input Sample

```
2
```

## Explanation of the Sample

If we mark the two cells which you can reach but from which you can not reach the destination with '`X`', the map will look like this:

```
5 5
--+-+
..|#X
..|##
S-+-T
####X
```