Paul Lu, Nov. 19, 2020

CMPUT 274 - Tangible Computing
Morning Problem: Skyscrapers

Description

You've just won the lottery and are thinking about buying a luxury condominium downtown. You know that the top-floor penthouses are really expensive because they're exclusive: if you own the top floor of the highest skyscraper, there's literally nobody else as high as you. But a ground-floor apartment is cheap because every building has a ground floor, so it's not as special to own one.

To help you make this trade-off, you've obtained a list of all the buildings downtown and how many levels each has. You want to find out how exclusive it is to live at level j, i.e. the number of buildings that have at least j levels.

Input

The first line of the input contains the single integer n, the number of buildings in your list (at most 10^6). Each of the following n lines contains the single integer x_i ($1 \leq i \leq n$ and $1 \leq x_i \leq 10^6$), which is the number of levels in building i.

Output

You should output m lines, where $m = max_i * x_i$, i.e. the number of levels in the tallest building. The jth line should contain a single integer: how many buildings have at least j levels.

For example, the first line should just be n, since every building has at least one level. The last (mth) line should be the number of buildings that are all the tallest.

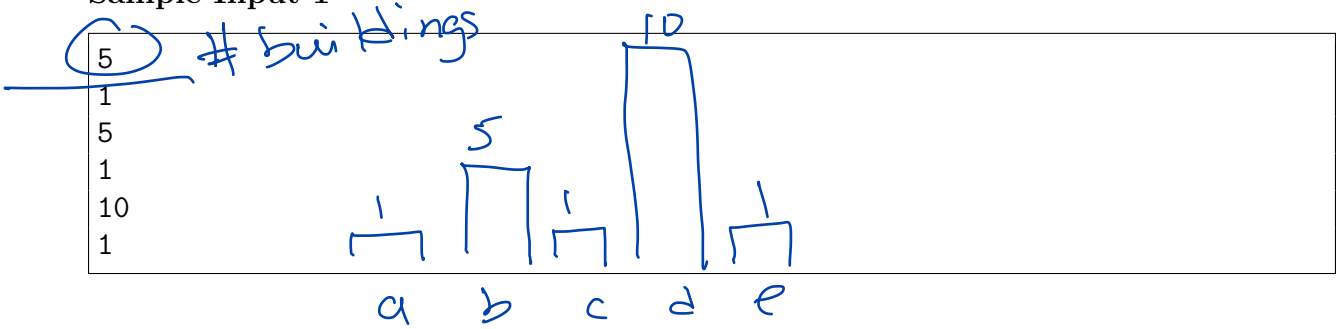
Hint:

Note that the time limit is 5 seconds and some inputs are big. An $O(nm)$ solution will not be fast enough to meet the time limit.

Note, there are multiple solutions to this problem, some use a sort algorithm, you can sort a python list named "a" by typing $a = sorted(a)$, sort is an $O(nlogn)$ algorithm.

Sample Input 1

```
5
1
5
1
10
1
```



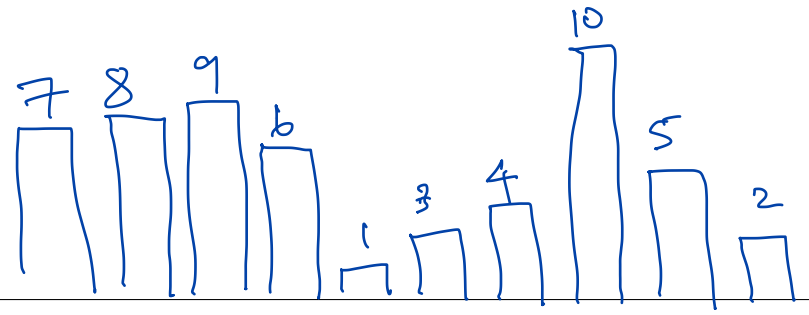
Sample Output 1

```
5
2
2
2
2
1
1
1
1
1
```

Explanation: All 5 buildings have at least one level, 2 buildings have at least 2, 3, 4, or 5, levels, and only one building (the tallest) has 6, 7, 8, 9, or 10 levels.

Sample Input 2

```
10
7
8
9
6
1
3
4
10
5
2
```



Sample Output 2

```
10
9
8
7
6
5
4
3
2
1
```

Explanation: There are 10 buildings, of heights, 1, 2, 3, ..., 10, so there are 10 buildings with at least 1 level, 9 buildings with at least 2 levels, etc.

Final words: The goal of Morning Problems is to learn and practice algorithmic problem solving. Therefore:

1. Any submitted solution which does not use a problem-specific algorithm (in the judgment of the Instructor or Teaching Assistants) to solve the given problem will be considered incorrect.

   For example, pattern matching based on the input data and then echoing the output given in the Testcenter, would be considered to be an incorrect solution since it is input-output pattern matching, instead of an algorithm to solve the given problem.

2. Any submitted solution (i.e., Python, C, C++ source code) in excess of 8 kilobytes (KB) in size will be considered incorrect. All Morning Problems can be solved with programs small enough to fit within 8 KB of source code.

Good luck!