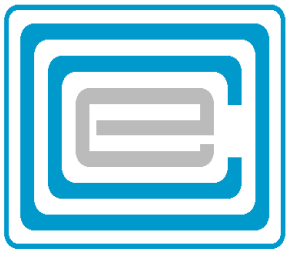

ECOO 2019

Programming Contest Questions

Provincial Competition (Round 2)

April 27, 2019

Problem 1: Email

A seldom-known fact about email addresses is that you can format a given address in several different ways. In particular:

- The entire address is case-insensitive.
- Dots ('.') before the at-sign ('@') sign are ignored.
- A plus ('+') followed by any string can be added before the at-sign ('@'). The plus and following string are ignored.

For example, "foo@bar.com" and "fO.o+baz123@bAR.com" refer to the same email address.

John runs a service where users sign up with their email address. He has noticed that some users have signed up multiple times using different representations of the same address. He has asked for your help to determine the number of unique email addresses that have signed up on his site.

Input Specifications

DATA11.txt (DATA12.txt for the second try) will contain 10 datasets. Each dataset begins with a line containing an integer **N** ($1 \le \mathbf{N} \le 100{,}000$), the number of email addresses. The next **N** lines each contain an email address **S** ($1 \le |\mathbf{S}| \le 30$). The email address will be formatted as a non-empty user part consisting of letters, numbers, dots, and pluses followed by a single at-sign followed by a non-empty domain part consisting of letters, numbers, and dots.

For the first 6 cases, $\mathbf{N} \le 100$.

Output Specifications

For each dataset, output the number of unique email addresses in the dataset.

Sample Input (Two Datasets Shown)

```
3
foo@bar.com
fO.o+baz123@bAR.com
foo@bar..com
3
c++@foo.com
c...@Foo.com
.c+c@FOO.COM
```

Sample Output

```
2
1
```


ECOO 2019 Question Development Team

John Ketelaars ..... ECOO-CS Communications
David Stermole ..... ECOO-CS President
Reyno Tilikaynen ..... University of Waterloo
Andrew Seidel ..... John Fraser Secondary School, Mississauga
Tongbo Sui ..... Google

Problem 2: Pizza

Alice and Bob like to eat lunch at Polypizza, a hip new pizzeria that lets you choose the shape of your pizza. Whenever they come at Polypizza, Alice and Bob order a single pizza in the shape of a polygon that they like on that day. Since they want to share the pizza equally, they want the pizza to be symmetrical. They have asked for your help in determining how many reflective symmetries their pizza has (as they are too busy choosing the shapes of their toppings).

Alice and Bob's pizza has **N** distinct vertices. For any pair of two vertices **A** and **B**, the pizza is said to have reflectional symmetry over the line **L** passing through **A** and **B** if for every vertex **C**, there exists a different vertex located at the reflection of **C** over **L**. Two symmetries are considered different if their unordered pair of points {**A**, **B**} is different.

Input Specifications

DATA21.txt (DATA22.txt for the second try) will contain 10 datasets. Each dataset begins with a single integer **N** ($3 \le N \le 5000$), the number of vertices that the pizza has. The next **N** lines each contain two integers X_i, Y_i ($0 \le X_i, Y_i \le 10^6$) which describe the vertices in clockwise order. The pizza is guaranteed to not have any intersecting edges.

For the first 3 datasets, $N \le 50$.
For the first 7 datasets, $N \le 500$.

Output Specifications

For each dataset, output the number of reflectional symmetries that the pizza has.

Sample Input (Two Datasets Shown)

```
4
0 0
1 1
1 2
2 0
4
0 0
0 1
1 1
1 0
```

Sample Output

```
0
2
```

Problem 3: Ribbon

After wrapping a present for her friend's birthday, Elaine discovered that she has a long length of ribbon left over. The ribbon is currently unwound, so she decided that she will fold the ribbon **M** times before putting it away in a small box. To make sure the ribbon will fit, she would like to know what the length and thickness of the ribbon will be once she performs her sequence of folds.

The ribbon initially has a length of **N** units and a thickness of 1 unit. When folding a ribbon at a point **P** from the left, the part of the ribbon left of **P** is folded onto the part of the ribbon right of **P**. Formally, for all **K** > 0, the thickness of the ribbon at the point **P - K** is added to the thickness at the point **P** + **K -** 1 and the thickness at the point **P - K** becomes zero. Folding the ribbon from the right is the same up to symmetry.

The thickness of the ribbon is defined as the maximum thickness of any given point. The length of the ribbon is defined as the number of points with non-zero thickness. Given the sequence of **M** folds, can you help Elaine determine the dimensions of the final ribbon?

Input Specifications

DATA31.txt (DATA32.txt for the second try) will contain 10 datasets. Each dataset begins with two integers **N**, **M** (1 ≤ **N** ≤ 10,000,000, 1 ≤ **M** ≤ 1,000,000), the initial length of the ribbon and the number of folds. The points of the ribbon are numbered from 1 to **N**.

The next **M** lines each contain an integer **P** (1 ≤ **P** ≤ **N**) followed by either 'L' or 'R', representing a fold at point **P** from either the left or right. The point **P** is guaranteed to be at a point with non-zero thickness.

For the first 3 cases, each fold will be of type 'L'.
For the first 6 cases, **N** ≤ 1,000.

Output Specifications

For each dataset, output two space-separated integers: the length and thickness of the ribbon.

Sample Input (Two Datasets Shown)

```
6 1
3 L
10 2
10 L
10 R
```

Sample Output

```
4 2
8 3
```

Explanation of Sample Datasets

In the first dataset, the thickness of the ribbon at each point is '2', '2', '1', '1'.
In the second dataset, the thickness of the ribbon at each point is '1', '1', '1', '1', '1', '1', '1', '3'.

Problem 4: Tunnels

The city of Otnorot is considering battling congestion on its subway lines by adding relief tunnels along each line. A relief tunnel is an additional tunnel that runs along a subsegment of the line which allows extra trains to operate in that subsegment.

Each segment between two consecutive stops of a subway line requires some minimum amount of relief lines to operate without congestion. The cost to build a relief tunnel is a fixed start up cost **S** and an additional rate **R** for each segment the relief tunnel services.

Given the number of additional relief tunnels required for each segment, what is the minimum cost required to meet the requirements?

Input Specifications

DATA41.txt (DATA42.txt for the second try) will contain 10 datasets. Each dataset begins with three terms **N**, **R, S** ($1 \le$ **N, R, S** $\le 1{,}000{,}000$), the number of segments on the subway line, the rate per segment, and the fixed cost. The next line contains **N** integers $\mathbf{A}_i$ ($0 \le \mathbf{A}_i \le 1{,}000{,}000$), the number of additional relief tunnels required in the **i**-th segment.

For the first 3 cases, $\mathbf{A}_i \le 1$.
For the first 6 cases, **N** $\le 1{,}000$.

Output Specifications

For each dataset, output the minimum cost required to meet the relief tunnel requirements.

Sample Input (Two Datasets Shown)

```
4 1 2
2 1 1 2
5 1 10
2 1 1 1 2
```

Sample Output

```
12
30
```

Explanation of Sample Datasets

In the first dataset, it's best to have one tunnel run the length of the line, one tunnel only service the first segment, and one tunnel only service the last segment. This has a total cost of (2+4) + (2+1) + (2+1) = 12.
In the second dataset, it's best to have two tunnels run the length of the line due to the high start up cost. This has a total cost of (10+5) + (10+5) = 30.