

Homework 1

1. Fertile grasslands

Ghita the Shepherd is looking for new grasslands for his flock of sheep. He obtained from the city hall the maps of different grasslands, each with an area of $N \times N$.

The map is represented as an $N \times N$ matrix where each element represents a $1\text{m} \times 1\text{m}$ patch of land. Each patch of land is encoded with 1 if it is fertile or 0 if it has no grass.

Ghita asks you to help him determine the how many patches of size 1×1 , 2×2 , 3×3 , $N \times N$ of fertile grass there are for each map. A fertile ground may not contain patches without grass. The patches may overlap.

Input data

In the file *grassland.in* we can find:

- On the first line the number N
- On the next N lines, the map of the grassland

Output data

In the file *grassland.out* output the number of patches of area $L \times L$ where L takes values from 1 to N

On the first line the number of fertile areas of 1×1
On the second line the number of fertile areas of 2×2
.....
On the n -th line the number of fertile areas of $N \times N$

Example

grassland.in	grassland.out
6	33
1 1 1 1 1 0	16
1 1 0 1 1 1	4
1 1 1 1 1 1	1
1 1 1 1 0 1	0
1 1 1 1 1 1	0
1 1 1 1 1 1	

There are 33 areas of 1×1 , 16 areas of 2×2 , 4 areas of 3×3 and 1 area of 4×4

Restrictions

- $N < 1001$
- Maximum execution time : 0.25s

2.Lego Disaster

At the LEGO factory a huge amount of lego parts are created each day. Each lego part has a unique identification number.

One part of their assembly line is responsible of inserting lego parts into a queue based on the identifier such that the parts are always in ascending order.

But today this part of the assembly is malfunctioning and the workers need to determine how bad the situation is. The workers have a list with the identification numbers of the parts in the order they came out of the assembly line.

The workers want to know how many pairs for 2 parts are in the wrong order. They have asked you to build a program that computes this.

Input data

In the file *lego.in* we can find:

- On the first line the number N – the number of parts
- On the next line N numbers representing the identification numbers in the order they came out of the assembly line

Output data

In the file *lego.out* output the number of pairs that are in the wrong order

Example

lego.in	lego.out
7 1 21 5 3 12 23 2	9

Explanation: (21, 5) (21,3) (21, 12) (21,2) (5,3) (5,2) (3,2) (12,2) (23,2)

Restrictions:

- $2 \leq n \leq 100\,000$
- Maximum execution time : 0.2s

Sending the solutions

The solutions should have a Readme file that should contain:

1. a short description of the algorithms you used,
2. the complexity of the algorithms (you must compute it).

Send the solutions in a .zip archive with the name HW_<number>_<name>_<group>.zip (e.g. HW_1_PopescuAndrei_1231E.zip) by email to: alexandru.daniel.mirea@gmail.com

The deadline for receiving the homework is 2nd of December 2013, at 23:59.

Rules for assignments: <http://adcfils.wordpress.com/assignments/>