

*All the programs were tested on IBM PC Pentium, 100 MHz computers.*

**A BANK** (Poland)

*30 points, run time limit – 15 sec.*

BOC, the greatest bank of Cumberland with  $n$  branches across the country, has just installed a new computer system. Unfortunately, the process of installation has mixed the databases. Each branch has got a database that may belong to another branch. BOC can work properly only if each branch has its own database.

Any two branches can exchange databases that they possess, and such an operation takes one day. Disjoint pairs of branches can exchange their databases during the same day.

The customers wish to know how long BOC will not work properly due to the information ordering. Write a program which:

- reads the number  $n$  of branches from the input file BOC.IN, and reads whose database it has got for each branch
- finds the minimal number of days needed to put all databases in their proper places.
- writes an outcome to the text file BOC.OUT.

**Input Data**

The first line of the input file BOC.IN contains the number  $n$  of BOC branches, where:  $1 \leq n \leq 10000$ . There is a sequence of  $n$  unique integer numbers in the following  $n$  lines. The number  $k$  in the line  $i+1$  means that the branch number  $i$  has got a database that belongs to the branch number  $k$ .

**Output Data**

The output file BOC.OUT must contain one integer, i.e. the minimal number of days required to order the information.

**Example**

INPUT (file BOC.IN)	OUTPUT (file BOC.OUT)
4	2
4	
3	
1	
2	

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### **3.5 ANCIENT CHRONICLES (Latvia)**

*30 points, run time limit – 3 min.*

When investigating ancient chronicles, historian Pavingstone found out that a part of data about ancient people can be written as the relation of two people's ages in the form : “*is older than*”, “*is younger than*”, “*is as old as*”. For example, it would be possible to fix the following facts: “Maryann is younger than Victor”, “Romeo is as old as Juliet”.

To process the data obtained in this way with a computer, Pavingstone made the corresponding file where he coded each person with two capital letters of the Latin alphabet, while the age relations as “<” (*is younger than*), “>” (*is older than*), “=” (*is as old as*). It is known, that the number of persons mentioned in the chronicles does not exceed 500.

Write a program which for the given data determines the age relation of two persons mentioned in the chronicles if it is known that the data collected by Pavingstone may be incomplete, but they definitely are not contradictory.

#### **Input Data**

One positive integer  $n$  ( $n \leq 30000$ ) is given in the first line of the text file AGE.DAT.

Each of the following  $n$  file lines contains 5 characters describing the age relation between two persons. Each line is in the following form:

1st and 2nd characters	– Person's code
3rd characters	– Relation (one of the three characters > < =)
4th and 5th characters	– Person's code

One positive integer  $m$  ( $m \leq 1000$ ) is given in the first line of the text file AGE.ASK.

Each of the following  $m$  file lines contains 5 characters describing two persons whose age relation we want to know. Each line is in the following form:

1st and 2nd character	– Person's code
3rd character	– ?
4th and 5th character	– Person's code

#### **Output Data**

Text file AGE.REZ must contain  $m$  lines. Each line must contain 5 characters. In the  $i^{\text{th}}$  line there must be an “answer” to the “question” given in the  $(i+1)^{\text{th}}$  line of the text file AGE.ASK in the following form:

1st and 2nd character	– Person's code
3rd character	– Relation (one of the four characters > < = ?)
4th and 5th character	– Person's code

The relation must be characterised as “?” only if it is impossible to determine the age relation of these two persons from the input data.

**Example**

*Text of the chronicle:* “**Harold** was younger than **Leo** and **Mode**. His opponent **Henrich** was as old as **Harold** and older than his sister **Ann**”.

INPUT files

AGE.DAT

4

HA<LE

HA<MO

HE=HA

HE>AN

AGE.ASK

3

MO?AN

HA?HE

LE?MO

OUTPUT file

AGE.REZ

MO>AN

HA=HE

LE?MO

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**FIGURES** (Estonia)

40 points, run time limit – 30 sec.

We are given a chessboard-patterned (alternating black and white squares) rectangular piece of paper (dimensions  $V$  by  $H$  cells) that has a black cell in its bottom-left corner.

We have to cut a connected figure with exactly  $B$  black and  $W$  white cells out of this paper. A figure may have holes in it, but it must be connected. Two cells are connected if they have a common side.

Count the number of different figures that can be cut out of this piece of paper. Two figures are considered different if one cannot be transformed into another by rotating.

**Input Data**

There are integers  $V$  and  $H$  ( $V, H \leq 8$ ) on the first line of the input file FIGURES.DAT, and the integers  $B$  and  $W$  ( $B + W \leq 12$ ) – on the second line.

**Output Data**

Write the number of different figures to the first line of the output file FIGURES.REZ.

**Example**

INPUT	OUTPUT
(file FIGURES.DAT)	(file FIGURES.REZ)
4 2	8
2 2	

*Comment*

The 8 figures are:

BW	BWB	BWB	WBWB
WB	W	W	
WBW	BW	WB	WBW
B	BW	WB	B