International Collegiate Programming Contest

2021

Latin American Regional Contests

April 2, 2022

Warmup Session

This problem set contains 3 problems; pages are numbered from 1 to 4.

This problem set is used in simultaneous contests hosted in the following countries:

Argentina, Bolivia, Brasil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Jamaica, México, Nicaragua, Perú, Puerto Rico, República Dominicana, Trinidad y Tobago and Venezuela

General information

Unless otherwise stated, the following conditions hold for all problems.

Program name

1. Your solution must be called *codename*`.c`, *codename*`.cpp`, *codename*`.java`, *codename*`.kt`, *codename*`.py3`, where *codename* is the capital letter which identifies the problem.

Input

1. The input must be read from standard input.
2. The input consists of a single test case, which is described using a number of lines that depends on the problem. No extra data appear in the input.
3. When a line of data contains several values, they are separated by *single* spaces. No other spaces appear in the input. There are no empty lines.
4. The English alphabet is used. There are no letters with tildes, accents, diaereses or other diacritical marks (ñ, Ã, é, Ì, ô, Ü, ç, etcetera).
5. Every line, including the last one, has the usual end-of-line mark.

Output

1. The output must be written to standard output.
2. The result of the test case must appear in the output using a number of lines that depends on the problem. No extra data should appear in the output.
3. When a line of results contains several values, they must be separated by *single* spaces. No other spaces should appear in the output. There should be no empty lines.
4. The English alphabet must be used. There should be no letters with tildes, accents, diaereses or other diacritical marks (ñ, Ã, é, Ì, ô, Ü, ç, etcetera).
5. Every line, including the last one, must have the usual end-of-line mark.
6. To output real numbers, round them to the closest rational with the required number of digits after the decimal point. Test case is such that there are no ties when rounding as specified.

Problem A – Almost Origami

Author: Alejandro Strejilevich de Loma, Argentina

You have a rectangular sheet of paper of height 1 and you want to locate any point at height H measured from the bottom border of the sheet. Since you do not know Haga's theorems, you plan to repeat the following step. Assume you already located a point P_L at height L on the left border of the sheet, and a point P_R at height R on the right border of the sheet. Then you draw a line from the lower left corner of the sheet to P_R, and another line from the lower right corner of the sheet to P_L. If the crossing point is at height H, then you are done. Otherwise you draw a horizontal line that passes through the crossing point and go for another step.

As an example, consider the case $H = 1/3$. During the first step, the only possibility is choosing the upper corners of the sheet (that is, $L = R = 1$). So you draw the two diagonals of the sheet, and the crossing point is at height $1/2$. Since $H \neq 1/2$, you draw a horizontal line that passes through the crossing point. This line provides two new points with known height $1/2$ on the borders of the sheet, one on the left border and the other one on the right border. For the second step you can choose between using the original known points at height 1, or the points you have just located at height $1/2$. That is, you can choose either $L = 1$ or $L = 1/2$ and of course $R = 1$ or $R = 1/2$. It is easy to see that if you choose $L = R = 1/2$, then the crossing point would be at height $1/4$. However, if you choose $L = 1/2$ and $R = 1$, then the crossing point would be at the desired height $H = 1/3$. By symmetry, the same occurs if you choose $L = 1$ and $R = 1/2$.

Given a rational height H, you must determine a shortest sequence of heights on the borders of the sheet that allows locating a point at height H.

As the above example shows, only a point at height $1/2$ can be located in a single step, and so a possible shortest sequence for $H = 1/3$ is $S = (1, 1, 1/2, 1)$. The first two heights must be chosen during the first step, and the remaining two heights must be chosen during the second step.

Input

The input consists of a single line that contains two integers M and N ($1 \leq M < N \leq 100$) such that $H = M/N$ is an irreducible fraction.

Output

Output a single line with the character "*" (asterisk) if a point at height H cannot be located by means of the described procedure. Otherwise, output a shortest sequence of heights $S_1, S_2, \ldots, S_K$ that allows locating a point at height H, if they are chosen in the order they appear in the sequence. Height S_i must be written in the i-th line using two integers A_i and B_i such that $S_i = A_i/B_i$ is an irreducible fraction ($i = 1, 2, \ldots, K$). It is guaranteed that when a point at height H can be located, it can be optimally located choosing only rational heights.

Sample input 1	Sample output 1
1 3	1 1 1 1 1 2 1 1

Sample input 2	Sample output 2
1 3	1 1 1 1 1 1 1 2

Sample input 3	Sample output 3
3 4	*

Sample input 4	Sample output 4
1 4	1 1 1 1 1 2 1 2

Problem B – Mountain Ranges

Author: Vinicius Santos, Brasil

Famous for its mountain ranges, Nlogonia attracts millions of tourists every year. The government has a dedicated budget for continuous maintenance of the hiking trails spread across the country and most of them are filled with scenic viewpoints, accessible through wooden walkways and stairs.

Currently on a trip through Nlogonia and with hopes of going back home with lots of breath-taking pictures, Lola and her husband want to visit as many viewpoints as possible. They plan to hike a different trail each day and explore its viewpoints. However, to avoid being exhausted at the end of the day, if moving from one viewpoint to the next requires going up more than X meters they simply call it a day and go back to their hotel in order to get some rest. Fortunately, every hiking trail in Nlogonia is equipped with modern chairlifts, so the couple can start hiking the trail at any viewpoint they decide. Once the hiking begins the couple only moves towards the peak of the mountain.

To make sure she doesn't waste a day Lola only wants to hike on trails where she'll get to a reasonable number of viewpoints. Given the altitudes of the scenic viewpoints on a hiking trail, you must determine the maximum number of viewpoints that the couple can visit.

Input

The first line contains two integers N ($1 \le N \le 1000$) and X ($0 \le X \le 8848$), indicating respectively the number of scenic viewpoints on the hiking trail, and the maximum number of meters that Lola and her husband are willing to go up from one viewpoint to the next. The second line contains N integers $A_1, A_2, \ldots, A_N$ ($1 \le A_i \le 8848$ for $i = 1, 2, \ldots, N$), where A_i is the altitude (in meters) of the i-th viewpoint. Viewpoints are given in the order they appear on the hiking trail and their altitudes are non-decreasing, that is, $A_i \le A_{i+1}$ for $i = 1, 2, \ldots, N - 1$.

Output

Output a single line with an integer indicating the maximum number of scenic viewpoints that can be visited without going up more than X meters from one viewpoint to the next, and considering that the journey can be started at any viewpoint.

Sample input 1	**Sample output 1**
`9 2` `3 14 15 92 653 5897 5897 5898 5900`	`4`

Sample input 2	**Sample output 2**
`9 0` `3 14 15 92 653 5897 5897 5898 5900`	`2`

Sample input 3	**Sample output 3**
`9 8848` `3 14 15 92 653 5897 5897 5898 5900`	`9`

Problem C – Non-Integer Donuts

Author: Paulo Cezar Pereira Costa, Brasil

Neil is a very important lawyer with a very important bank account. Since Neil is such a successful lawyer with many clients, he deposits money to his account every single morning.

After going to the bank and depositing money, Neil goes to work. And there lies Neil's great weakness: a donut shop. You see, Neil is a recovering donut addict, and although he hasn't eaten a donut in years, he can't help but wonder how many \$1.00 donuts he could buy with the money in his account if he were to relapse.

Having \$5.00 in his account means 5 donuts Neil could have, but what about \$4.50? Well, that is more than 4 donuts for sure, but definitely less than 5. How would one even buy a non-integer amount of donuts? That concept confuses Neil, so every time his account balance is not an integer, he stops to ponder the nature of non-integer donuts and ends up being late to work.

Now Neil has been late too many times and is starting to worry he will lose his job. He wants to know how many times he will be late to work during the next N days, given his initial account balance and the amount of money he will deposit each day. Please answer this for him, or else Neil will start pondering again.

Input

The first line contains an integer N ($1 \leq N \leq 1000$), the number of days Neil is interested in. Each of the next $N+1$ lines contains a string representing an amount of money. The first string is Neil's account initial balance, while the following N strings are the amounts Neil will deposit to his account in the different days. Each string has the form $\$X.Y$ where X is a substring of length 1 or 2 indicating the whole money in the amount $\$X.Y$, while Y is a substring of length exactly 2 denoting the cents in the amount $\$X.Y$. Both X and Y are made of digits, at least one of them contains a non-zero digit, and X does not have leading zeros.

Output

Output a single line with an integer indicating how many times Neil will be late to work during the following N days.

Sample input 1	Sample output 1
1 \$1.57 \$3.14	1

Sample input 2	Sample output 2
4 \$1.00 \$0.01 \$0.99 \$10.00 \$98.76	2