Problem A. Approximate Answer

Time Limit	1000 ms
Code Length Limit	50000 B
OS	Linux

Problem Link

You are solving a problem whose correct answer is the integer Y.
The answer you obtained, however, is the integer X.

Your answer will be considered correct if the difference between X and Y is at most K.
In other words, your answer is considered correct if and only if:

$$|X - Y| \leq K$$

Given the values of X, Y, and K, determine whether your answer X is correct or not.

Note that $|x|$ denotes the absolute value of x.
For example, $|12| = 12$, $|-15| = 15$, and $|0| = 0$.

Input Format

- The first and only line of input will contain three space-separated integers X, Y and K — your answer, the correct answer, and the the maximum allowed difference, respectively.

Output Format

Output the answer on a single line: `"Yes"` if your answer is considered correct, and `"No"` otherwise (without quotes).

Each letter of the output may be printed in either uppercase or lowercase, i.e, the strings `NO`, `no`, `No`, and `nO` will all be treated as equivalent.

Constraints

- $1 \leq X, Y, K \leq 20$

Sample 1

Input	Output
10 5 4	No

$|X - Y| = |10 - 5| = 5$, while $K = 4$. Since $|X - Y| > K$, the answer is not considered correct.

Sample 2

Input	Output
10 5 5	Yes

$|X - Y| = |10 - 5| = 5$, while $K = 5$. Since $|X - Y| \leq K$, the answer is considered correct.

Problem B. GamingForces

Time Limit 2000 ms
Mem Limit 262144 kB

Problem Link

Monocarp is playing a computer game. He's going to kill n monsters, the i-th of them has h_i health.

Monocarp's character has two spells, either of which he can cast an arbitrary number of times (possibly, zero) and in an arbitrary order:

- choose exactly two alive monsters and decrease their health by 1;
- choose a single monster and kill it.

When a monster's health becomes 0, it dies.

What's the minimum number of spell casts Monocarp should perform in order to kill all monsters?

Input

The first line contains a single integer t ($1 \le t \le 10^4$) — the number of testcases.

The first line of each testcase contains a single integer n ($1 \le n \le 100$) — the number of monsters.

The second line contains n integers $h_1, h_2, \ldots, h_n$ ($1 \le h_i \le 100$) — the health of each monster.

The sum of n over all testcases doesn't exceed $2 \cdot 10^4$.

Output

For each testcase, print a single integer — the minimum number of spell casts Monocarp should perform in order to kill all monsters.

Examples

Input	Output
3 4 1 2 1 2 3 2 4 2 5 1 2 3 4 5	3 3 5

Note

In the first testcase, the initial health list is $[1, 2, 1, 2]$. Three spells are casted:

- the first spell on monsters 1 and 2 — monster 1 dies, monster 2 has now health 1, new health list is $[0, 1, 1, 2]$;
- the first spell on monsters 3 and 4 — monster 3 dies, monster 4 has now health 1, new health list is $[0, 1, 0, 1]$;
- the first spell on monsters 2 and 4 — both monsters 2 and 4 die.

In the second testcase, the initial health list is $[2, 4, 2]$. Three spells are casted:

- the first spell on monsters 1 and 3 — both monsters have health 1 now, new health list is $[1, 4, 1]$;
- the second spell on monster 2 — monster 2 dies, new health list is $[1, 0, 1]$;
- the first spell on monsters 1 and 3 — both monsters 1 and 3 die.

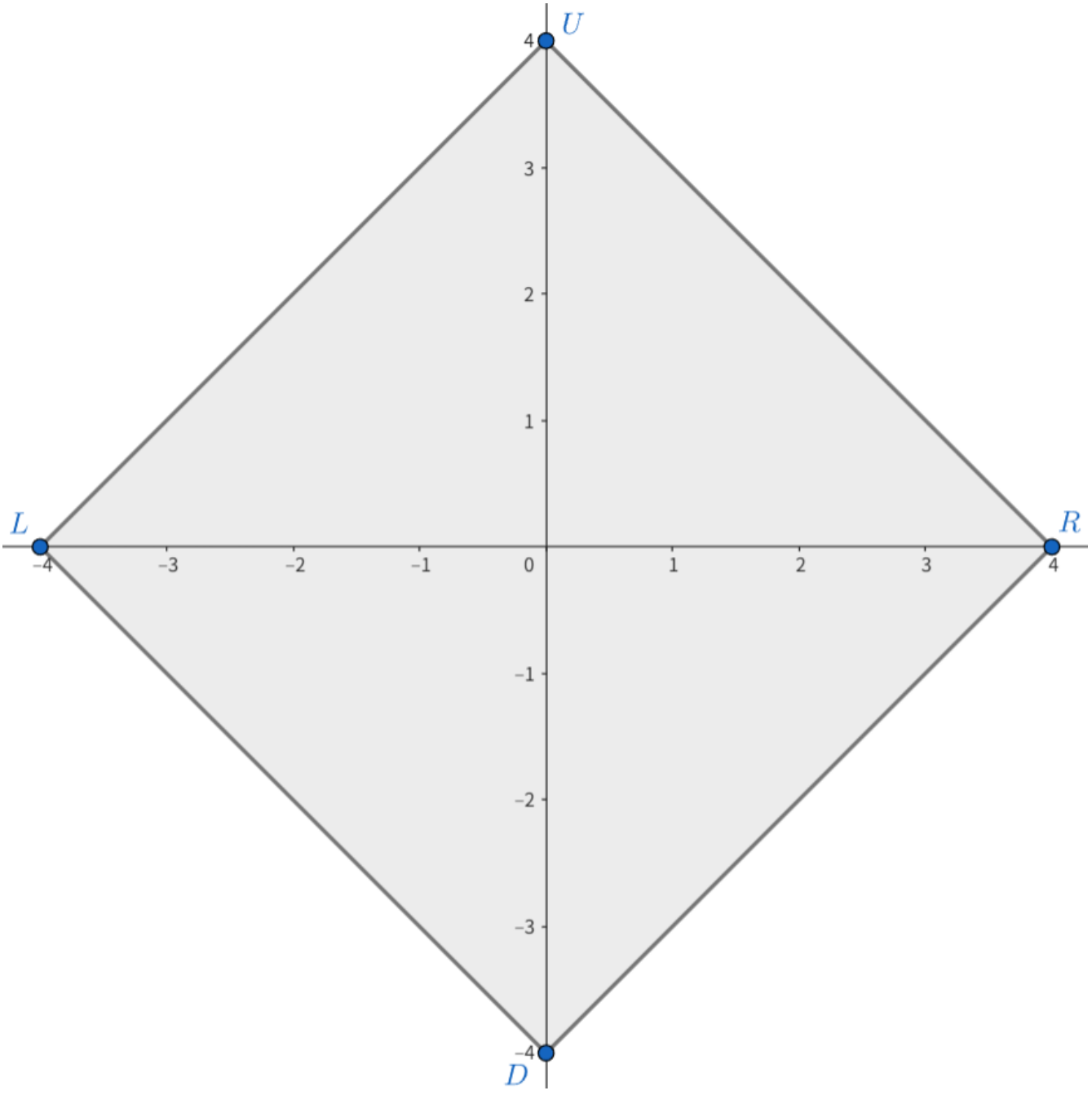
In the third testcase, the initial health list is $[1, 2, 3, 4, 5]$. Five spells are casted. The i-th of them kills the i-th monster with the second spell. Health list sequence: $[1, 2, 3, 4, 5] \rightarrow [0, 2, 3, 4, 5] \rightarrow [0, 0, 3, 4, 5] \rightarrow [0, 0, 0, 4, 5] \rightarrow [0, 0, 0, 0, 5] \rightarrow [0, 0, 0, 0, 0]$.

Problem C. Draw a Square

Time Limit 1000 ms
Mem Limit 262144 kB

Problem Link

The pink soldiers have given you 4 **distinct points** on the plane. The 4 points' coordinates are $(-l, 0)$, $(r, 0)$, $(0, -d)$, $(0, u)$ correspondingly, where l, r, d, u are positive integers.



In the diagram, a square is drawn by connecting the four points L, R, D, U.

Please determine if it is possible to draw a square* with the given points as its vertices.

*A *square* is defined as a polygon consisting of 4 vertices, of which all sides have equal length and all inner angles are equal. No two edges of the polygon may intersect each other.

Input

Each test contains multiple test cases. The first line contains the number of test cases t ($1 \leq t \leq 10^4$). The description of the test cases follows.

The first line of each test case contains four integers l, r, d, u ($1 \leq l, r, d, u \leq 10$).

Output

For each test case, if you can draw a square using the four points, output "`Yes`". Otherwise, output "`No`".

You can output the answer in any case. For example, the strings "`yEs`", "`yes`", and "`YES`" will also be recognized as positive responses.

Examples

Input	Output
2 2 2 2 2 1 2 3 4	Yes No

Note

On the first test case, the four given points form a square, so the answer is "`Yes`".

On the second test case, the four given points do not form a square, so the answer is "`No`".

Problem D. Mahmoud and Ehab and the MEX

Time Limit 2000 ms
Mem Limit 262144 kB

Dr. Evil kidnapped Mahmoud and Ehab in the evil land because of their performance in the Evil Olympiad in Informatics (EOI). He decided to give them some problems to let them go.

Dr. Evil is interested in sets, He has a set of n integers. Dr. Evil calls a set of integers *evil* if the *MEX* of it is exactly x. the *MEX* of a set of integers is the minimum non-negative integer that doesn't exist in it. For example, the *MEX* of the set $\{0, 2, 4\}$ is 1 and the *MEX* of the set $\{1, 2, 3\}$ is 0 .

Dr. Evil is going to make his set *evil*. To do this he can perform some operations. During each operation he can add a non-negative integer to his set or erase an element from it. What is the minimal number of operations Dr. Evil has to perform to make his set *evil*?

Input

The first line contains two integers n and x ($1 \le n \le 100, 0 \le x \le 100$) — the size of the set Dr. Evil owns, and the desired *MEX*.

The second line contains n distinct non-negative integers not exceeding 100 that represent the set.

Output

The only line should contain one integer — the minimal number of operations Dr. Evil should perform.

Examples

Input	Output
5 3 0 4 5 6 7	2

Input	Output
1 0 0	1

Input	Output
5 0 1 2 3 4 5	0

Note

For the first test case Dr. Evil should add 1 and 2 to the set performing 2 operations.

For the second test case Dr. Evil should erase 0 from the set. After that, the set becomes empty, so the *MEX* of it is 0.

In the third test case the set is already *evil*.

Problem E. Twin Permutations

Time Limit 1000 ms
Mem Limit 262144 kB

Problem Link

You are given a permutation[†] a of length n.

Find any permutation b of length n such that $a_1 + b_1 \leq a_2 + b_2 \leq a_3 + b_3 \leq \ldots \leq a_n + b_n$.

It can be proven that a permutation b that satisfies the condition above always exists.

[†] A permutation of length n is an array consisting of n distinct integers from 1 to n in arbitrary order. For example, $[2, 3, 1, 5, 4]$ is a permutation, but $[1, 2, 2]$ is not a permutation (2 appears twice in the array), and $[1, 3, 4]$ is also not a permutation ($n = 3$ but there is 4 in the array).

Input

Each test contains multiple test cases. The first line of input contains a single integer t ($1 \leq t \leq 2000$) — the number of test cases. The description of test cases follows.

The first line of each test case contains a single integer n ($1 \leq n \leq 100$) — the length of permutations a and b.

The second line of each test case contains n distinct integers $a_1, a_2, \ldots, a_n$ ($1 \leq a_i \leq n$) — the elements of permutation a. All elements of a are distinct.

Note that there is no bound on the sum of n over all test cases.

Output

For each test case, output **any** permutation b which satisfies the constraints mentioned in the statement. It can be proven that a permutation b that satisfies the condition above always exists.

Examples

Input	Output
5 5 1 2 4 5 3 2 1 2 1 1 3 3 2 1 4 1 4 3 2	1 2 4 3 5 2 1 1 1 2 3 1 2 3 4

Note

In the first test case $a = [1, 2, 4, 5, 3]$. Then the permutation $b = [1, 2, 4, 3, 5]$ satisfies the condition because $1 + 1 \leq 2 + 2 \leq 4 + 4 \leq 5 + 3 \leq 3 + 5$.

Problem F. Buttons

Time Limit 2000 ms
Mem Limit 1048576 kB

Problem Link

Problem Statement

There are two buttons, one of size A and one of size B.

When you press a button of size X, you get X coins and the size of that button decreases by 1.

You will press a button twice. Here, you can press the same button twice, or press both buttons once.

At most how many coins can you get?

Constraints

- All values in input are integers.
- $3 \leq A, B \leq 20$

Input

Input is given from Standard Input in the following format:

```
A B
```

Output

Print the maximum number of coins you can get.

Sample 1

Input	Output
5 3	9

You can get $5 + 4 = 9$ coins by pressing the button of size 5 twice, and this is the maximum result.

Sample 2

Input	Output
3 4	7

Sample 3

Input	Output
6 6	12

Problem G. Not Found

Time Limit 2000 ms

Problem Link

Problem Statement

You are given a string S consisting of lowercase English letters. Find the lexicographically (alphabetically) smallest lowercase English letter that does not occur in S. If every lowercase English letter occurs in S, print `None` instead.

Constraints

- $1 \leq |S| \leq 10^5$ ($|S|$ is the length of string S.)
- S consists of lowercase English letters.

Input

Input is given from Standard Input in the following format:

```
S
```

Output

Print the lexicographically smallest lowercase English letter that does not occur in S. If every lowercase English letter occurs in S, print `None` instead.

Sample 1

Input	Output
`atcoderregularcontest`	`b`

The string `atcoderregularcontest` contains `a`, but does not contain `b`.

Sample 2

Input	Output
abcdefghijklmnopqrstuvwxyz	None

This string contains every lowercase English letter.

Sample 3

Input	Output
fajsonlslfepbjtsaayxbymeskptcumtwrmkkinjxnnucagfrg	d

Problem H. How many?

Time Limit 2000 ms

Problem Link

Problem Statement

How many triples of non-negative integers (a, b, c) satisfy $a + b + c \leq S$ and $a \times b \times c \leq T$?

Constraints

- $0 \leq S \leq 100$
- $0 \leq T \leq 10000$
- S and T are integers.

Input

Input is given from Standard Input in the following format:

```
S T
```

Output

Print the number of triples of non-negative integers (a, b, c) satisfying the conditions.

Sample 1

Input	Output
1 0	4

The triples (a, b, c) satisfying the conditions are $(0, 0, 0)$, $(0, 0, 1)$, $(0, 1, 0)$, and $(1, 0, 0)$ — there are four of them.

Sample 2

Input	Output
2 5	10

Sample 3

Input	Output
10 10	213

Sample 4

Input	Output
30 100	2471

Problem I. Minor Change

Time Limit 2000 ms
Mem Limit 1048576 kB

Problem Link

Problem Statement

Given are strings S and T. Consider changing S to T by repeating the operation below. Find the minimum number of operations required to do so.

Operation: Choose one character of S and replace it with a different character.

Constraints

- S and T have lengths between 1 and 2×10^5 (inclusive).
- S and T consists of lowercase English letters.
- S and T have equal lengths.

Input

Input is given from Standard Input in the following format:

```
S
T
```

Output

Print the answer.

Sample 1

Input	Output
cupofcoffee cupofhottea	4

We can achieve the objective in four operations, such as the following:

- First, replace the sixth character `c` with `h`.
- Second, replace the eighth character `f` with `t`.
- Third, replace the ninth character `f` with `t`.
- Fourth, replace the eleventh character `e` with `a`.

Sample 2

Input	Output
abcde bcdea	5

Sample 3

Input	Output
apple apple	0

No operations may be needed to achieve the objective.

Problem J. R2

Time Limit	1000 ms
Mem Limit	1048576 kB
OS	Linux

Problem Link

The number S is called the mean of two numbers R_1 and R_2 if S is equal to $(R_1 + R_2)/2$. Mirko's birthday present for Slavko was two integers R_1 and R_2. Slavko promptly calculated their mean which also happened to be an integer but then lost R_2! Help Slavko restore R_2.

Input

The first and only line of input contains two integers R_1 and S, both between $-1\,000$ and $1\,000$.

Output

Output R_2 on a single line.

Sample 1

Input	Output
11 15	19

Sample 2

Input	Output
4 3	2

Problem K. Odd Echo

Time Limit	1000 ms
Mem Limit	1048576 kB
OS	Linux

Problem Link

ECHO! Echo! Ech...

You love shouting in caves to hear your words echoed back at you. Unfortunately, as a hard-working software engineer you are not lucky enough to get out that often to shout in caves. Instead, you would like to implement a program that serves as a replacement for a cave.

Every now and then, you want to input a few words into the program and have them echoed back to you. However, as is well known, if you shout too quickly in a cave, the echo might cause interference with the new words you say. More specifically, every other word you say will interfere with the echo of your previous word. Thus only the first, third, fifth, and so on, words will actually produce an echo.

Your task is to write a program that simulates this behavior.

Input

The first line of the input contains an integer N ($1 \leq N \leq 10$).

The next N lines each contains a word. Each word is at most 100 letters long, and contains only letters ‘a-z‘.

Output

Output the odd-indexed (i.e. first, third, fifth, and so on) words in the input.

Scoring

Your solution will be tested on a set of test groups, each worth a number of points. To get the points for a test group you need to solve all test cases in the test group.

Group	Points	Constraints

1	1	N is always 5
2	1	No additional constraints

Sample 1

Input	Output
5 hello i am an echo	hello am echo

Sample 2

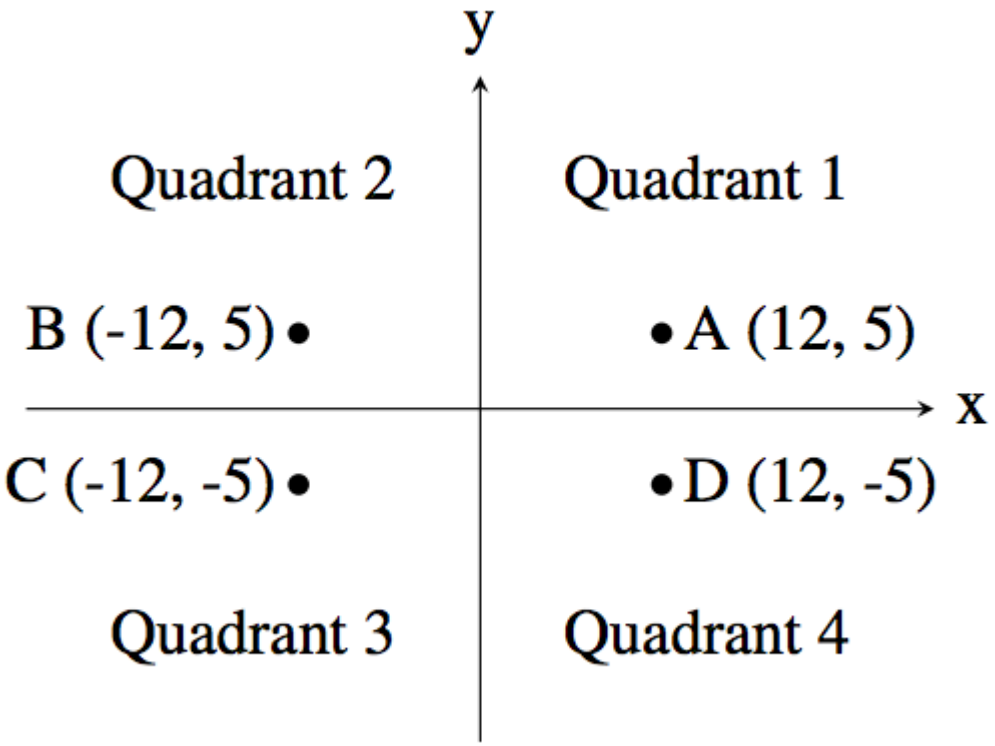
Input	Output
10 only if these oddindexed words appear are you correct output	only these words are correct

Problem L. Quadrant Selection

Time Limit	1000 ms
Mem Limit	1048576 kB
OS	Linux

Problem Link

A common problem in mathematics is to determine which quadrant a given point lies in. There are four quadrants, numbered from 1 to 4, as shown in the diagram below:



For example, the point A, which is at coordinates $(12, 5)$ lies in quadrant 1 since both its x and y values are positive, and point B lies in quadrant 2 since its x value is negative and its y value is positive.

Your job is to take a point and determine the quadrant it is in. You can assume that neither of the two coordinates will be 0.

Input

The first line of input contains the integer x ($-1000 \leq x \leq 1000; x \neq 0$). The second line of input contains the integer y ($-1000 \leq y \leq 1000; y \neq 0$).

Output

Output the quadrant number (1, 2, 3 or 4) for the point (x, y).

Sample 1

Input	Output
10 6	1

Sample 2

Input	Output
9 -13	4

Problem M. Solving for Carrots

Time Limit	1000 ms
Mem Limit	1048576 kB
OS	Linux

Carrots are good for you! First of all, they give you good night vision. Instead of having your lights on at home, you could eat carrots and save energy! Ethnomedically, it has also been shown that the roots of carrots can be used to treat digestive problems. In this contest, you also earn a carrot for each difficult problem you solve, or huffle-puff problems as we prefer to call them.

You will be given the number of contestants in a hypothetical contest, the number of huffle-puff problems that people solved in the contest and a description of each contestant. Now, forget about the contestants, just find the number of carrots that will be handed out during the contest.

Input

Input starts with two integers $1 \leq N, P \leq 1\,000$ on a single line, denoting the number of contestants in the contest and the number of huffle-puff problems solved in total. Then follow N lines, each consisting of a single non-empty line in which the contestant describes him or herself. You may assume that the contestants are good at describing themselves, in a way such that an arbitrary 5-year-old with hearing problems could understand it.

Output

Output should consist of a single integer: the number of carrots that will be handed out during the contest.

Sample 1

Input	Output
2 1 carrots? bunnies	1

Sample 2

Input	Output
1 5 sovl problmz	5

Problem N. Autori

Time Limit	1000 ms
Mem Limit	1048576 kB
OS	Linux

Problem Link

Great scientific discoveries are often named by the last names of scientists that made them. For example, the most popular asymmetric cryptography system, RSA was discovered by Rivest, Shamir and Adleman. Another notable example is the Knuth-Morris-Pratt algorithm, named by Knuth, Morris and Pratt.

Scientific papers reference earlier works a lot and it's not uncommon for one document to use two different naming conventions: the short variation (e.g. KMP) using only the first letters of authors last names and the long variation (e.g. Knuth-Morris-Pratt) using complete last names separated by hyphens.

We find mixing two conventions in one paper to be aesthetically unpleasing and would like you to write a program that will transform long variations into short.

Input

The first and only line of input will contain at most 100 characters, uppercase and lowercase letters of the English alphabet and hyphen ('-' ASCII 45). The first character will always be an uppercase letter. Hyphens will always be followed by an uppercase letter. All other characters will be lowercase letters.

Output

The first and only line of output should contain the appropriate short variation.

Sample 1

Input	Output
Knuth-Morris-Pratt	KMP

Sample 2

Input	Output
Mirko-Slavko	MS

Sample 3

Input	Output
Pasko-Patak	PP

Problem O. Hissing Microphone

Time Limit	1000 ms
Mem Limit	1048576 kB
OS	Linux

Problem Link

A known problem with some microphones is the “hissing s”. That is, sometimes the sound of the letter s is particularly pronounced; it stands out from the rest of the word in an unpleasant way.

Of particular annoyance are words that contain the letter s twice in a row. Words like `amiss`, `kiss`, `mississippi` and even `hiss` itself.

Input

The input contains a single string on a single line. This string consists of only lowercase letters (no spaces) and has between 1 and 30 characters.

Output

Output a single line. If the input string contains two consecutive occurrences of the letter `s`, then output `hiss`. Otherwise, output `no hiss`.

Sample 1

Input	Output
amiss	hiss

Sample 2

Input	Output
octopuses	no hiss

Sample 3

Input	Output
hiss	hiss

Problem P. Quality-Adjusted Life-Year

Time Limit	1000 ms
Mem Limit	1048576 kB
OS	Linux

Problem Link

The Quality-Adjusted Life-Year (QALY) is a way to measure a person's quality of life that includes both the quality and the quantity of life lived.

The quality of life lived can be quantified as a number between 0 and 1. If someone is living with perfect health, the quality of life is 1. If someone is dead, then the quality of life is 0. The quality of life may increase or decrease due to medical treatements, sickness, etc.

The QALY for each period in which the quality of life is constant is simply the product of the quality of life and the length of the period (in years). We wish to know the amount of QALY accumulated by a person at the time of death, given the complete history of this person.

Input

The first line of input contains a single integer N ($1 \leq N \leq 100$), which is the number of periods of constant quality of life during the person's lifetime.

The next N lines describe the periods of life. Each of these lines contains two real numbers q ($0 < q \leq 1$), which is the quality of life in this period, and y ($0 < y \leq 100$), which is the number of years in this period. All real numbers will be specified to exactly one decimal place.

Output

Display the QALY accumulated by the person. Your answer will be considered correct if its absolute error does not exceed 10^{-3}.

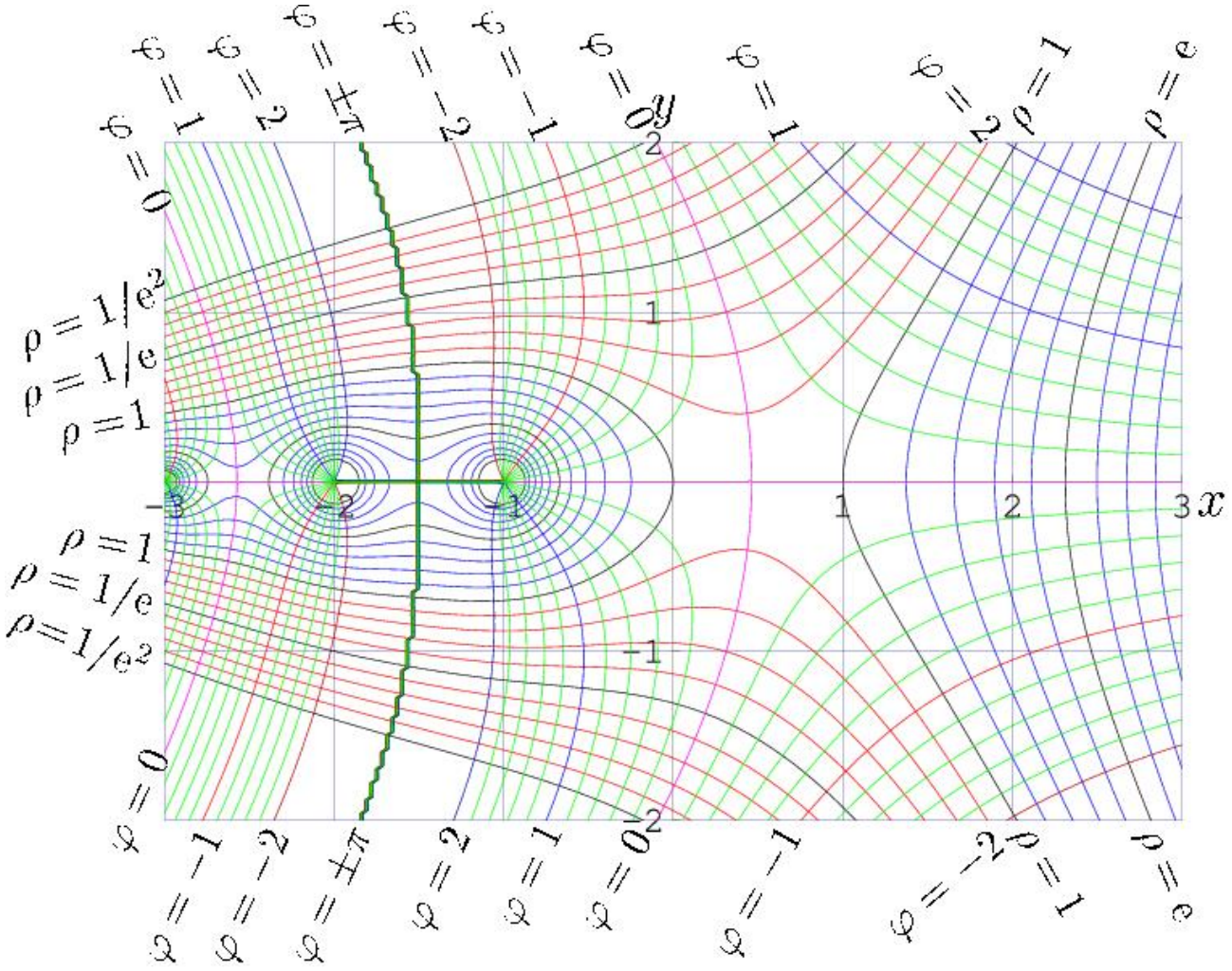
Sample 1

Input	Output
5 1.0 12.0 0.7 5.2 0.9 10.7 0.5 20.4 0.2 30.0	41.470

Problem Q. Last Factorial Digit

Time Limit	1000 ms
Mem Limit	1048576 kB
OS	Linux

Problem Link



The factorial of N, written as $N!$, is defined as the product of all the integers from 1 to N. For example, $3! = 1 \times 2 \times 3 = 6$.

This number can be very large, so instead of computing the entire product, just compute the last digit of $N!$ (when $N!$ is written in base 10).

Input

The first line of input contains a positive integer $1 \leq T \leq 10$, the number of test cases. Each of the next T lines contains a single positive integer N. N is at most 10.

Output

For each value of N, print the last digit of $N!$.

Sample 1

Input	Output
3 1 2 3	1 2 6

Sample 2

Input	Output
2 5 2	0 2

Problem R. Missing Number

Time Limit 1000 ms
Mem Limit 524288 kB

Problem Link

You are given all numbers between $1, 2, \ldots, n$ except one. Your task is to find the missing number.

Input

The first input line contains an integer n.

The second line contains $n - 1$ numbers. Each number is distinct and between 1 and n (inclusive).

Output

Print the missing number.

Constraints

- $2 \leq n \leq 2 \cdot 10^5$

Example

Input	Output
5 2 3 1 5	4

Problem S. Increasing Array

Time Limit 1000 ms
Mem Limit 524288 kB

Problem Link

You are given an array of n integers. You want to modify the array so that it is increasing, i.e., every element is at least as large as the previous element.

On each move, you may increase the value of any element by one. What is the minimum number of moves required?

Input

The first input line contains an integer n: the size of the array.

Then, the second line contains n integers $x_1, x_2, \ldots, x_n$: the contents of the array.

Output

Print the minimum number of moves.

Constraints

- $1 \leq n \leq 2 \cdot 10^5$
- $1 \leq x_i \leq 10^9$

Example

Input	Output
5 3 2 5 1 7	5

Problem T. Relational Operator

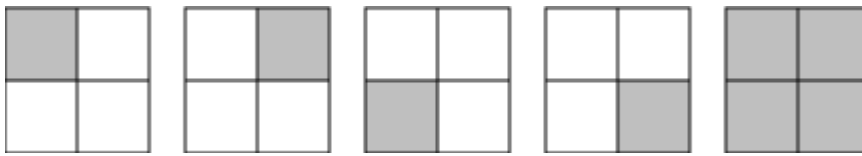
Time Limit	3000 ms
OS	Linux
Statement	PDF

Problem Link

Richard Phillips Feynman was a well known American physicist and a recipient of the Nobel Prize in Physics. He worked in theoretical physics and also pioneered the field of quantum computing. He visited South America for ten months, giving lectures and enjoying life in the tropics. He is also known for his books "Surely You're Joking, Mr. Feynman!" and "What Do You Care What Other People Think?", which include some of his adventures below the equator.

His life-long addiction was solving and making puzzles, locks, and cyphers. Recently, an old farmer in South America, who was a host to the young physicist in 1949, found some papers and notes that is believed to have belonged to Feynman. Among notes about mesons and electromagnetism, there was a napkin where he wrote a simple puzzle: "how many different squares are there in a grid of $N \times N$ squares?".

In the same napkin there was a drawing which is reproduced below, showing that, for $N = 2$, the answer is 5.



Input

The input contains several test cases. Each test case is composed of a single line, containing only one integer N, representing the number of squares in each side of the grid ($1 \leq N \leq 100$).

The end of input is indicated by a line containing only one zero.

Output

For each test case in the input, your program must print a single line, containing the number of different squares for the corresponding input.

Sample Input

```
2
1
8
0
```

Sample Output

```
5
1
204
```