Programación Competitiva

Semana i (2018) – Contest #3

Problema 1 - Vanya and Triangles

Vanya got bored and he painted n distinct points on the plane. After that he connected all the points pairwise and saw that as a result many triangles were formed with vertices in the painted points. He asks you to count the number of the formed triangles with the non-zero area.

Input

The first line contains integer n ($1 \le n \le 2000$) — the number of the points painted on the plane.

Next n lines contain two integers each x_i, y_i ($-100 \le x_i, y_i \le 100$) — the coordinates of the i-th point. It is guaranteed that no two given points coincide.

Output

In the first line print an integer — the number of triangles with the non-zero area among the painted points.

Examples

Input
```
4
0 0
1 1
2 0
2 2
```
Output
```
3
```

Input
```
3
0 0
1 1
2 0
```
Output
```
1
```

Input
```
1
1 1
```
Output
```
0
```

Note

Note to the first sample test. There are 3 triangles formed: (0,0) - (1,1) - (2,0); (0,0) - (2,2) - (2,0); (1,1) - (2,2) - (2,0).

Note to the second sample test. There is 1 triangle formed: (0,0) - (1,1) - (2,0).

Note to the third sample test. A single point doesn't form a single triangle.

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Semana i (2018) – Contest #3

Problema 2 - Password

Asterix, Obelix and their temporary buddies Suffix and Prefix has finally found the Harmony temple. However, its doors were firmly locked and even Obelix had no luck opening them.

A little later they found a string *s*, carved on a rock below the temple's gates. Asterix supposed that that's the password that opens the temple and read the string aloud. However, nothing happened. Then Asterix supposed that a password is some substring *t* of the string *s*.

Prefix supposed that the substring *t* is the beginning of the string *s*; Suffix supposed that the substring *t* should be the end of the string *s*; and Obelix supposed that *t* should be located somewhere inside the string *s*, that is, *t* is neither its beginning, nor its end.

Asterix chose the substring *t* so as to please all his companions. Besides, from all acceptable variants Asterix chose the longest one (as Asterix loves long strings). When Asterix read the substring *t* aloud, the temple doors opened.

You know the string *s*. Find the substring *t* or determine that such substring does not exist and all that's been written above is just a nice legend.

Input

You are given the string *s* whose length can vary from 1 to 10^6 (inclusive), consisting of small Latin letters.

Output

Print the string *t*. If a suitable *t* string does not exist, then print "Just a legend" without the quotes.

Examples

Input
```
fixprefixsuffix
```
Output
```
fix
```

Input
```
abcdabc
```
Output
```
Just a legend
```

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Problema 3 - Crazy Town

Crazy Town is a plane on which there are n infinite line roads. Each road is defined by the equation $a_i x + b_i y + c_i = 0$, where a_i and b_i are not both equal to the zero. The roads divide the plane into connected regions, possibly of infinite space. Let's call each such region a block. We define an intersection as the point where at least two different roads intersect.

Your home is located in one of the blocks. Today you need to get to the University, also located in some block. In one step you can move from one block to another, if the length of their common border is nonzero (in particular, this means that if the blocks are adjacent to one intersection, but have no shared nonzero boundary segment, then it are not allowed to move from one to another one in one step).

Determine what is the minimum number of steps you have to perform to get to the block containing the university. It is guaranteed that neither your home nor the university is located on the road.

Input

The first line contains two space-separated integers x_1, y_1 ($-10^6 \le x_1, y_1 \le 10^6$) — the coordinates of your home.

The second line contains two integers separated by a space x_2, y_2 ($-10^6 \le x_2, y_2 \le 10^6$) — the coordinates of the university you are studying at.

The third line contains an integer n ($1 \le n \le 300$) — the number of roads in the city. The following n lines contain 3 space-separated integers ($-10^6 \le a_i, b_i, c_i \le 10^6$; $|a_i| + |b_i| > 0$) — the coefficients of the line $a_i x + b_i y + c_i = 0$, defining the i-th road. It is guaranteed that no two roads are the same. In addition, neither your home nor the university lie on the road (i.e. they do not belong to any one of the lines).

Output

Output the answer to the problem.

Examples

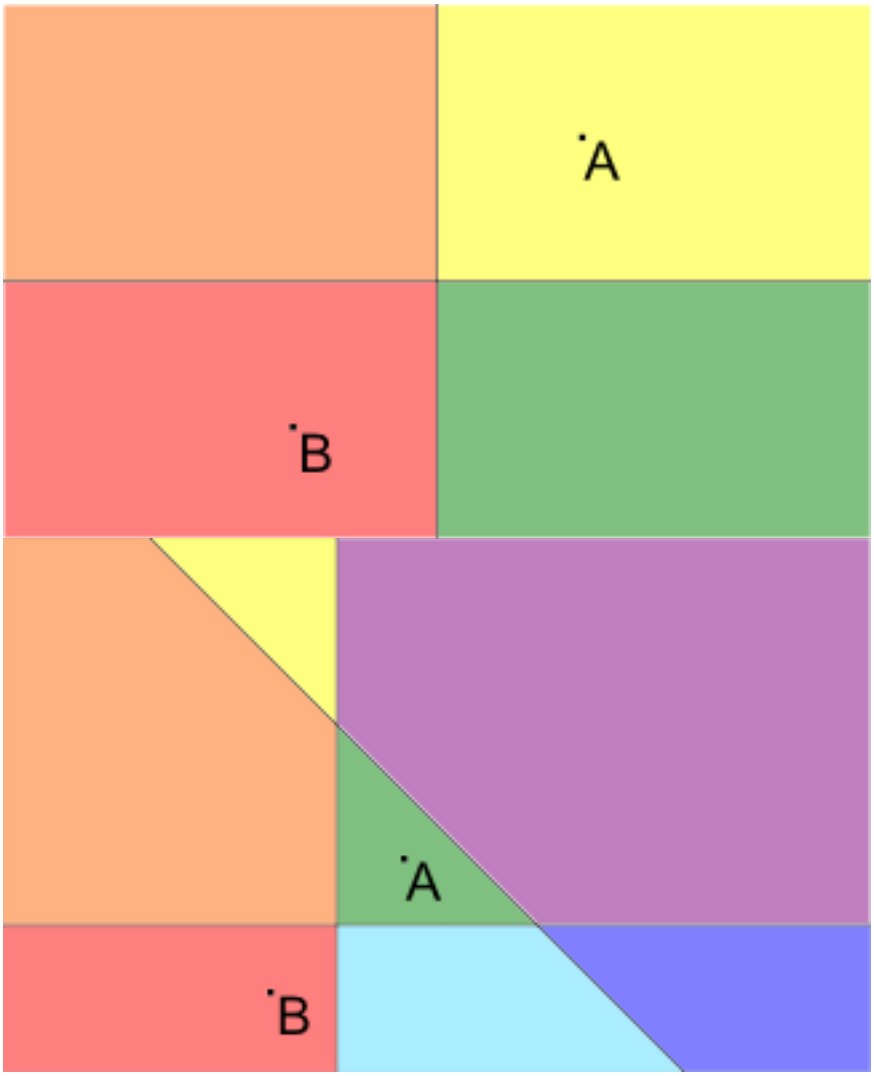
Input
```
1 1
-1 -1
2
0 1 0
1 0 0
```
Output
```
2
```

Input
```
1 1
-1 -1
3
1 0 0
0 1 0
1 1 -3
```

Output
2

Note

Pictures to the samples are presented below (A is the point representing the house; B is the point representing the university, different blocks are filled with different colors):



Problema 4 - Mammoth's Genome Decoding

The process of mammoth's genome decoding in Berland comes to its end!

One of the few remaining tasks is to restore unrecognized nucleotides in a found chain s. Each nucleotide is coded with a capital letter of English alphabet: 'A', 'C', 'G' or 'T'. Unrecognized nucleotides are coded by a question mark '?'. Thus, s is a string consisting of letters 'A', 'C', 'G', 'T' and characters '?'.

It is known that the number of nucleotides of each of the four types in the decoded genome of mammoth in Berland should be equal.

Your task is to decode the genome and replace each unrecognized nucleotide with one of the four types so that the number of nucleotides of each of the four types becomes equal.

Input

The first line contains the integer n ($4 \le n \le 255$) — the length of the genome.

The second line contains the string s of length n — the coded genome. It consists of characters 'A', 'C', 'G', 'T' and '?'.

Output

If it is possible to decode the genome, print it. If there are multiple answer, print any of them. If it is not possible, print three equals signs in a row: "===" (without quotes).

Examples

Input
```
8
AG?C??CT
```
Output
```
AGACGTCT
```

Input
```
4
AGCT
```
Output
```
AGCT
```

Input
```
6
????G?
```
Output
```
===
```

Input
```
4
AA??
```
Output
```
===
```

Note

In the first example you can replace the first question mark with the letter 'A', the second question mark with the letter 'G', the third question mark with the letter 'T', then each nucleotide in the genome would be presented twice.

In the second example the genome is already decoded correctly and each nucleotide is exactly once in it.

In the third and the fourth examples it is impossible to decode the genom.

Problema 5 - Han Solo and Lazer Gun

There are n Imperial stormtroopers on the field. The battle field is a plane with Cartesian coordinate system. Each stormtrooper is associated with his coordinates (x, y) on this plane.

Han Solo has the newest duplex lazer gun to fight these stormtroopers. It is situated at the point (x_0, y_0). In one shot it can can destroy all the stormtroopers, situated on some line that crosses point (x_0, y_0).

Your task is to determine what minimum number of shots Han Solo needs to defeat all the stormtroopers.

The gun is the newest invention, it shoots very quickly and even after a very large number of shots the stormtroopers don't have enough time to realize what's happening and change their location.

Input

The first line contains three integers n, x_0 и y_0 $(1 \le n \le 1000,\ -10^4 \le x_0, y_0 \le 10^4)$ — the number of stormtroopers on the battle field and the coordinates of your gun.

Next n lines contain two integers each x_i, y_i $(-10^4 \le x_i, y_i \le 10^4)$ — the coordinates of the stormtroopers on the battlefield. It is guaranteed that no stormtrooper stands at the same point with the gun. Multiple stormtroopers can stand at the same point.

Output

Print a single integer — the minimum number of shots Han Solo needs to destroy all the stormtroopers.

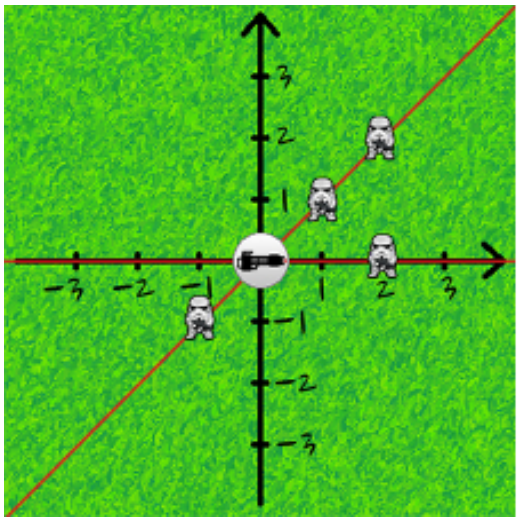
Examples

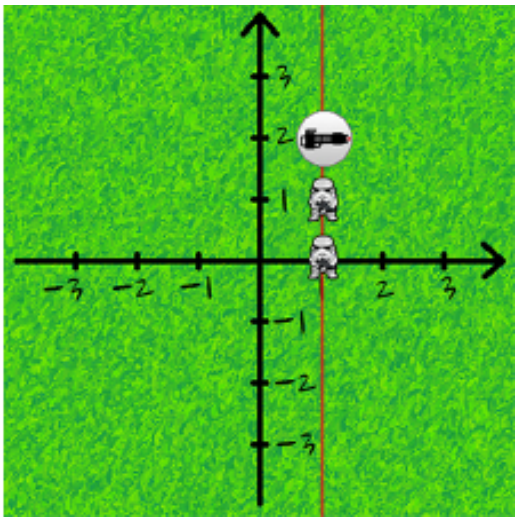
Input
```
4 0 0
1 1
2 2
2 0
-1 -1
```
Output
```
2
```

Input
```
2 1 2
1 1
1 0
```
Output
```
1
```

Note

Explanation to the first and second samples from the statement, respectively:





Problema 6 - The Text Splitting

You are given the string s of length n and the numbers p, q. Split the string s to pieces of length p and q.

For example, the string "Hello" for $p = 2, q = 3$ can be split to the two strings "Hel" and "lo" or to the two strings "He" and "llo".

Note it is allowed to split the string s to the strings only of length p or to the strings only of length q (see the second sample test).

Input

The first line contains three positive integers n, p, q ($1 \le p, q \le n \le 100$).

The second line contains the string s consists of lowercase and uppercase latin letters and digits.

Output

If it's impossible to split the string s to the strings of length p and q print the only number "-1".

Otherwise in the first line print integer k — the number of strings in partition of s.

Each of the next k lines should contain the strings in partition. Each string should be of the length p or q. The string should be in order of their appearing in string s — from left to right.

If there are several solutions print any of them.

Examples

Input
```
5 2 3
Hello
```
Output
```
2
He
llo
```

Input
```
10 9 5
Codeforces
```
Output
```
2
Codef
orces
```

Input
```
6 4 5
Privet
```
Output
```
-1
```

Input

```
8 1 1
abacabac
```

Output

```
8
a
b
a
c
a
b
a
c
```

Problema 7 - DNA Alignment

Vasya became interested in bioinformatics. He's going to write an article about similar cyclic DNA sequences, so he invented a new method for determining the similarity of cyclic sequences.

Let's assume that strings s and t have the same length n, then the function $h(s, t)$ is defined as the number of positions in which the respective symbols of s and t are the same. Function $h(s, t)$ can be used to define the function of Vasya distance $\varrho(s, t)$:

$$\rho(s,t) = \sum_{i=0}^{n-1} \sum_{j=0}^{n-1} h(\text{shift}(s,i), \text{shift}(t,j)),$$

where $\text{shift}(s, i)$ is obtained from string s, by applying left circular shift i times. For example,

$$\varrho("AGC", "CGT") =$$
$$h("AGC", "CGT") + h("AGC", "GTC") + h("AGC", "TCG") +$$
$$h("GCA", "CGT") + h("GCA", "GTC") + h("GCA", "TCG") +$$
$$h("CAG", "CGT") + h("CAG", "GTC") + h("CAG", "TCG") =$$
$$1 + 1 + 0 + 0 + 1 + 1 + 1 + 0 + 1 = 6$$

Vasya found a string s of length n on the Internet. Now he wants to count how many strings t there are such that the Vasya distance from the string s attains maximum possible value. Formally speaking, t must satisfy the equation: $\rho(s,t) = \max_{u:|u|=|s|} \rho(s,u)$.

Vasya could not try all possible strings to find an answer, so he needs your help. As the answer may be very large, count the number of such strings modulo $10^9 + 7$.

Input

The first line of the input contains a single integer n ($1 \le n \le 10^5$).

The second line of the input contains a single string of length n, consisting of characters "ACGT".

Output

Print a single number — the answer modulo $10^9 + 7$.

Examples

Input
```
1
C
```
Output
```
1
```

Input
```
2
AG
```
Output
```
4
```

Input
```
3
TTT
```
Output
```
1
```

Note

Please note that if for two distinct strings t_1 and t_2 values $\varrho(s, t_1)$ и $\varrho(s, t_2)$ are maximum among all possible t, then both strings must be taken into account in the answer even if one of them can be obtained by a circular shift of another one.

In the first sample, there is $\varrho("C", "C") = 1$, for the remaining strings t of length 1 the value of $\varrho(s, t)$ is 0.

In the second sample, $\varrho("AG", "AG") = \varrho("AG", "GA") = \varrho("AG", "AA") = \varrho("AG", "GG") = 4$.

In the third sample, $\varrho("TTT", "TTT") = 27$

Problema 8 - Randomizer

Gerald got tired of playing board games with the usual six-sided die, and he bought a toy called Randomizer. It functions as follows.

A Randomizer has its own coordinate plane on which a strictly convex polygon is painted, the polygon is called a basic polygon. If you shake a Randomizer, it draws some nondegenerate (i.e. having a non-zero area) convex polygon with vertices at some vertices of the basic polygon. The result of the roll (more precisely, the result of the shaking) is considered to be the number of points with integer coordinates, which were strictly inside (the points on the border are not considered) the selected polygon. Now Gerald is wondering: what is the expected result of shaking the Randomizer?

During the shaking the Randomizer considers all the possible non-degenerate convex polygons with vertices at the vertices of the basic polygon. Let's assume that there are k versions of the polygons. Then the Randomizer chooses each of them with probability $\frac{1}{k}$.

Input
The first line of the input contains a single integer n ($3 \le n \le 100\,000$) — the number of vertices of the basic polygon.
Next n lines contain the coordinates of the vertices of the basic polygon. The i-th of these lines contain two integers x_i and y_i ($-10^9 \le x_i, y_i \le 10^9$) — the coordinates of the i-th vertex of the polygon. The vertices are given in the counter-clockwise order.

Output

Print the sought expected value with absolute or relative error at most 10^{-9}.

Examples

Input
```
4
0 0
2 0
2 2
0 2
```
Output
```
0.2
```

Input
```
5
0 0
2 0
2 2
1 3
0 2
```
Output
```
0.8125
```

Note

A polygon is called strictly convex if it is convex and no its vertices lie on the same line.

Let's assume that a random variable takes values $x_1, ..., x_n$ with probabilities $p_1, ..., p_n$, correspondingly. Then the expected value of this variable equals to $\sum_{i=1}^{n} x_i p_i$.