Tinkoff Internship Warmup Round 2018 and Codeforces Round #475 (Div. 1)

A. Alternating Sum

1 second, 256 megabytes

You are given two integers a and b. Moreover, you are given a sequence $s_0, s_1, \dots, s_n$. All values in s are integers 1 or -1. It's known that sequence is k-periodic and k divides $n+1$. In other words, for each $k \leq i \leq n$ it's satisfied that $s_i = s_{i-k}$.

Find out the **non-negative** remainder of division of $\sum\limits_{i=0}^{n} s_i a^{n-i} b^i$ by $10^9 + 9$.

Note that the modulo is unusual!

Input

The first line contains four integers n, a, b and k $(1 \leq n \leq 10^9, 1 \leq a, b \leq 10^9, 1 \leq k \leq 10^5)$.

The second line contains a sequence of length k consisting of characters '+' and '-'.

If the i-th character (0-indexed) is '+', then $s_i = 1$, otherwise $s_i = -1$.

Note that only the first k members of the sequence are given, the rest can be obtained using the periodicity property.

Output

Output a single integer — value of given expression modulo $10^9 + 9$.

input

```
2 2 3 3
+-+
```

output

```
7
```

input

```
4 1 5 1
-
```

output

```
999999228
```

In the first example:

$(\sum\limits_{i=0}^{n} s_i a^{n-i} b^i)$ = $2^2 3^0 - 2^1 3^1 + 2^0 3^2$ = 7

In the second example:

$(\sum\limits_{i=0}^{n} s_i a^{n-i} b^i) = -1^4 5^0 - 1^3 5^1 - 1^2 5^2 - 1^1 5^3 - 1^0 5^4 = -781 \equiv 999999228$ (

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B. Destruction of a Tree

1 second, 256 megabytes

You are given a tree (a graph with n vertices and n - 1 edges in which it's possible to reach any vertex from any other vertex using only its edges).

A vertex can be destroyed if this vertex has even degree. If you destroy a vertex, all edges connected to it are also deleted.

Destroy all vertices in the given tree or determine that it is impossible.

Input

The first line contains integer n $(1 \leq n \leq 2 \cdot 10^5)$ — number of vertices in a tree.

The second line contains n integers $p_1, p_2, \dots, p_n$ $(0 \leq p_i \leq n)$. If $p_i \neq 0$ there is an edge between vertices i and p_i. It is guaranteed that the given graph is a tree.

Output

If it's possible to destroy all vertices, print "YES" (without quotes), otherwise print "NO" (without quotes).

If it's possible to destroy all vertices, in the next n lines print the indices of the vertices in order you destroy them. If there are multiple correct answers, print any.

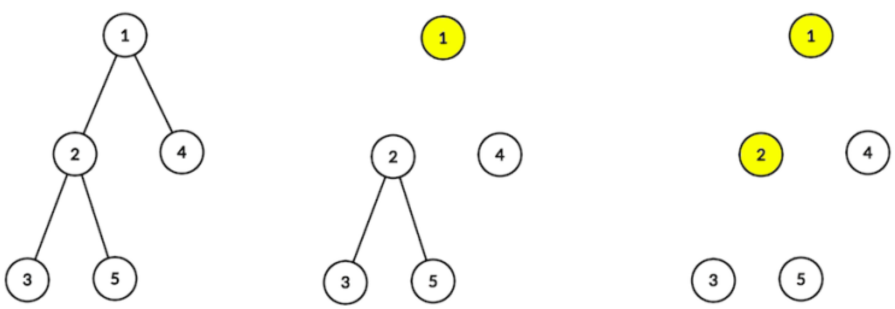
input
5 0 1 2 1 2

output
YES 1 2 3 5 4

input
4 0 1 2 3

output
NO

In the first example at first you have to remove the vertex with index 1 (after that, the edges (1, 2) and (1, 4) are removed), then the vertex with index 2 (and edges (2, 3) and (2, 5) are removed). After that there are no edges in the tree, so you can remove remaining vertices in any order.



C. Cutting Rectangle

2 seconds, 256 megabytes

A rectangle with sides A and B is cut into rectangles with cuts parallel to its sides. For example, if p horizontal and q vertical cuts were made, $(p+1) \cdot (q+1)$ rectangles were left after the cutting. After the cutting, rectangles were of n different types. Two rectangles are different if at least one side of one rectangle isn't equal to the corresponding side of the other. Note that the rectangle can't be rotated, this means that rectangles $a \times b$ and $b \times a$ are considered different if $a \neq b$.

For each type of rectangles, lengths of the sides of rectangles are given along with the amount of the rectangles of this type that were left after cutting the initial rectangle.

Calculate the amount of pairs $(A; B)$ such as the given rectangles could be created by cutting the rectangle with sides of lengths A and B. Note that pairs $(A; B)$ and $(B; A)$ are considered different when $A \neq B$.

Input

The first line consists of a single integer n $(1 \le n \le 2 \cdot 10^5)$ — amount of different types of rectangles left after cutting the initial rectangle.

The next n lines each consist of three integers w_i, h_i, c_i $(1 \le w_i, h_i, c_i \le 10^{12})$ — the lengths of the sides of the rectangles of this type and the amount of the rectangles of this type.

It is guaranteed that the rectangles of the different types are different.

Output

Output one integer — the answer to the problem.

input
1 1 1 9

output
3

input
2 2 3 20 2 4 40

output
6

input

```
2
1 2 5
2 3 5
```

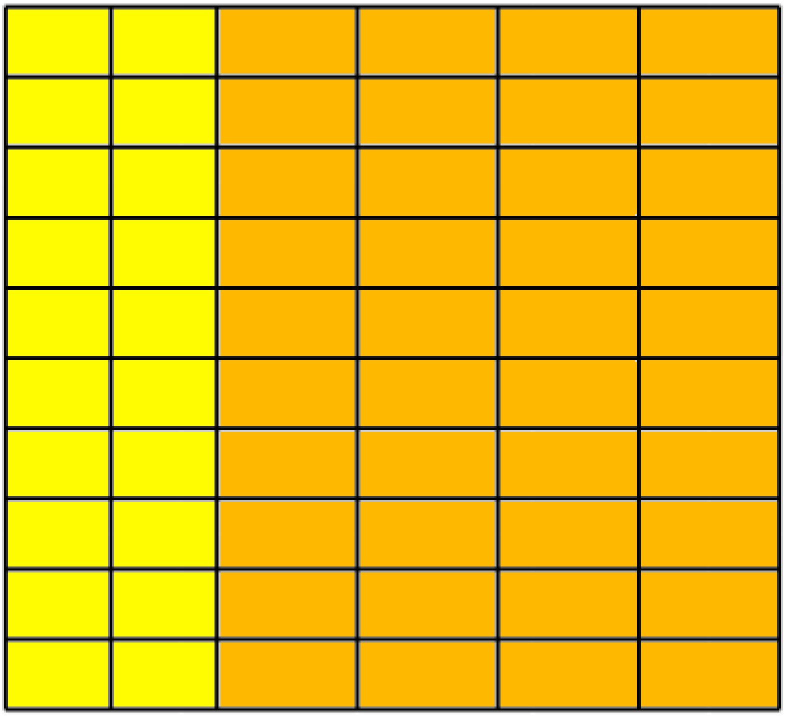
output

```
0
```

In the first sample there are three suitable pairs: $(1; 9)$, $(3; 3)$ and $(9; 1)$.

In the second sample case there are 6 suitable pairs: $(2; 220)$, $(4; 110)$, $(8; 55)$, $(10; 44)$, $(20; 22)$ and $(40; 11)$.

Here the sample of cut for $(20; 22)$.



The third sample has no suitable pairs.

D. Frequency of String

1.5 seconds, 512 megabytes

You are given a string s. You should answer n queries. The i-th query consists of integer k_i and string m_i. The answer for this query is the minimum length of such a string t that t is a substring of s and m_i has at least k_i occurrences as a substring in t.

A substring of a string is a continuous segment of characters of the string.

It is guaranteed that for any two queries the strings m_i from these queries are different.

Input

The first line contains string s $(1 \leq |s| \leq 10^5)$.

The second line contains an integer n ($1 \leq n \leq 10^5$).

Each of next n lines contains an integer k_i $(1 \leq k_i \leq |s|)$ and a non-empty string m_i — parameters of the query with number i, in this order.

All strings in input consists of lowercase English letters. Sum of length of all strings in input doesn't exceed 10^5. All m_i are distinct.

Output

For each query output the answer for it in a separate line.

If a string m_i occurs in s less that k_i times, output `-1`.

input

```
aaaaa
5
3 a
3 aa
2 aaa
3 aaaa
1 aaaaa
```

output

```
3
4
4
-1
5
```

input

```
abbb
7
4 b
1 ab
3 bb
1 abb
2 bbb
1 a
2 abbb
```

output

```
-1
2
-1
3
-1
1
-1
```

E. Circles of Waiting

2 seconds, 256 megabytes

A chip was placed on a field with coordinate system onto point $(0, 0)$.

Every second the chip moves randomly. If the chip is currently at a point (x, y), after a second it moves to the point $(x - 1, y)$ with probability p_1, to the point $(x, y - 1)$ with probability p_2, to the point $(x + 1, y)$ with probability p_3 and to the point $(x, y + 1)$ with probability p_4. It's guaranteed that $p_1 + p_2 + p_3 + p_4 = 1$. The moves are independent.

Find out the expected time after which chip will move away from origin at a distance greater than R (i.e. $x^2 + y^2 > R^2$ will be satisfied).

Input

First line contains five integers R, a_1, a_2, a_3 and a_4 $(0 \le R \le 50, 1 \le a_1, a_2, a_3, a_4 \le 1000)$.

Probabilities p_i can be calculated using formula $p_i = \frac{a_i}{a_1+a_2+a_3+a_4}$.

Output

It can be shown that answer for this problem is always a rational number of form $\frac{P}{Q}$, where $Q \not\equiv 0 \pmod{10^9 + 7}$.

Print $P \cdot Q^{-1}$ modulo $10^9 + 7$.

input

```
0 1 1 1 1
```

output

```
1
```

input

```
1 1 1 1 1
```

output

```
666666674
```

input

```
1 1 2 1 2
```

output

```
538461545
```

In the first example initially the chip is located at a distance 0 from origin. In one second chip will move to distance 1 is some direction, so distance to origin will become 1.

Answers to the second and the third tests: $\frac{8}{3}$ and $\frac{36}{13}$.