# A. Diana and Liana

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

At the first holiday in spring, the town Shortriver traditionally conducts a flower festival. Townsfolk wear traditional wreaths during these festivals. Each wreath contains exactly $k$ flowers.

The work material for the wreaths for all $n$ citizens of Shortriver is cut from the longest flowered liana that grew in the town that year. Liana is a sequence $a_1$, $a_2$, ..., $a_m$, where $a_i$ is an integer that denotes the type of flower at the position $i$. This year the liana is very long ($m \ge n \cdot k$), and that means every citizen will get a wreath.

Very soon the liana will be inserted into a special cutting machine in order to make work material for wreaths. The machine works in a simple manner: it cuts $k$ flowers from the beginning of the liana, then another $k$ flowers and so on. Each such piece of $k$ flowers is called a workpiece. The machine works until there are less than $k$ flowers on the liana.

Diana has found a weaving schematic for the most beautiful wreath imaginable. In order to weave it, $k$ flowers must contain flowers of types $b_1$, $b_2$, ..., $b_s$, while other can be of any type. If a type appears in this sequence several times, there should be at least that many flowers of that type as the number of occurrences of this flower in the sequence. The order of the flowers in a workpiece does not matter.

Diana has a chance to remove some flowers from the liana before it is inserted into the cutting machine. She can remove flowers from any part of the liana without breaking liana into pieces. If Diana removes too many flowers, it may happen so that some of the citizens do not get a wreath. Could some flowers be removed from the liana so that at least one workpiece would conform to the schematic and machine would still be able to create at least $n$ workpieces?

### Input

The first line contains four integers $m$, $k$, $n$ and $s$ ($1 \le n, k, m \le 5 \cdot 10^5$, $k \cdot n \le m$, $1 \le s \le k$): the number of flowers on the liana, the number of flowers in one wreath, the amount of citizens and the length of Diana's flower sequence respectively.

The second line contains $m$ integers $a_1$, $a_2$, ..., $a_m$ ($1 \le a_i \le 5 \cdot 10^5$) — types of flowers on the liana.

The third line contains $s$ integers $b_1$, $b_2$, ..., $b_s$ ($1 \le b_i \le 5 \cdot 10^5$) — the sequence in Diana's schematic.

### Output

If it's impossible to remove some of the flowers so that there would be at least $n$ workpieces and at least one of them fullfills Diana's schematic requirements, output $-1$.

Otherwise in the first line output one integer $d$ — the number of flowers to be removed by Diana.

In the next line output $d$ different integers — the positions of the flowers to be removed.

If there are multiple answers, print any.

#### Examples

**input**
```
7 3 2 2
1 2 3 3 2 1 2
2 2
```
**output**
```
1
4
```

**input**
```
13 4 3 3
3 2 6 4 1 4 4 7 1 3 3 2 4
4 3 4
```
**output**
```
-1
```

**input**
```
13 4 1 3
3 2 6 4 1 4 4 7 1 3 3 2 4
4 3 4
```
**output**

```
9
1 2 3 4 5 9 11 12 13
```

### Note

In the first example, if you don't remove any flowers, the machine would put out two workpieces with flower types $[1, 2, 3]$ and $[3, 2, 1]$. Those workpieces don't fit Diana's schematic. But if you remove flower on $4$-th place, the machine would output workpieces $[1, 2, 3]$ and $[2, 1, 2]$. The second workpiece fits Diana's schematic.

In the second example there is no way to remove flowers so that every citizen gets a wreath and Diana gets a workpiece that fits here schematic.

In the third example Diana is the only citizen of the town and that means she can, for example, just remove all flowers except the ones she needs.

## B. Once in a casino

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

One player came to a casino and found a slot machine where everything depends only on how he plays. The rules follow.

A positive integer $a$ is initially on the screen. The player can put a coin into the machine and then add $1$ to or subtract $1$ from any two adjacent digits. All digits must remain from $0$ to $9$ after this operation, and the leading digit must not equal zero. In other words, it is forbidden to add $1$ to $9$, to subtract $1$ from $0$ and to subtract $1$ from the leading $1$. Once the number on the screen becomes equal to $b$, the player wins the jackpot. $a$ and $b$ have the same number of digits.

Help the player to determine the minimal number of coins he needs to spend in order to win the jackpot and tell how to play.

### Input

The first line contains a single integer $n$ ($2 \le n \le 10^5$) standing for the length of numbers $a$ and $b$.

The next two lines contain numbers $a$ and $b$, each one on a separate line ($10^{n-1} \le a, b < 10^n$).

### Output

If it is impossible to win the jackpot, print a single integer $-1$.

Otherwise, the first line must contain the minimal possible number $c$ of coins the player has to spend.

$\min(c, 10^5)$ lines should follow, $i$-th of them containing two integers $d_i$ and $s_i$ ($1 \le d_i \le n - 1$, $s_i = \pm 1$) denoting that on the $i$-th step the player should add $s_i$ to the $d_i$-th and $(d_i + 1)$-st digits from the left (e. g. $d_i = 1$ means that two leading digits change while $d_i = n - 1$ means that there are two trailing digits which change).

Please notice that the answer may be very big and in case $c > 10^5$ you should print only the first $10^5$ moves. Your answer is considered correct if it is possible to finish your printed moves to win the jackpot in the minimal possible number of coins. In particular, if there are multiple ways to do this, you can output any of them.

### Examples

**input**
```
3
223
322
```
**output**
```
2
1 1
2 -1
```

**input**
```
2
20
42
```
**output**
```
2
1 1
1 1
```

**input**
```
2
35
44
```
**output**
```
-1
```

## Note

In the first example, we can make a +1 operation on the two first digits, transforming number $\mathbf{223}$ into $\mathbf{333}$, and then make a -1 operation on the last two digits, transforming $\mathbf{333}$ into $\mathbf{322}$.

It's also possible to do these operations in reverse order, which makes another correct answer.

In the last example, one can show that it's impossible to transform $35$ into $44$.

# C. Compress String

time limit per test: 3 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Suppose you are given a string $s$ of length $n$ consisting of lowercase English letters. You need to compress it using the smallest possible number of coins.

To compress the string, you have to represent $s$ as a concatenation of several non-empty strings: $s = t_1 t_2 \ldots t_k$. The $i$-th of these strings should be encoded with one of the two ways:

- if $|t_i| = 1$, meaning that the current string consists of a single character, you can encode it paying $a$ coins;
- if $t_i$ is a substring of $t_1 t_2 \ldots t_{i-1}$, then you can encode it paying $b$ coins.

A string $x$ is a substring of a string $y$ if $x$ can be obtained from $y$ by deletion of several (possibly, zero or all) characters from the beginning and several (possibly, zero or all) characters from the end.

So your task is to calculate the minimum possible number of coins you need to spend in order to compress the given string $s$.

## Input

The first line contains three positive integers, separated by spaces: $n$, $a$ and $b$ ($1 \leq n, a, b \leq 5000$) — the length of the string, the cost to compress a one-character string and the cost to compress a string that appeared before.

The second line contains a single string $s$, consisting of $n$ lowercase English letters.

## Output

Output a single integer — the smallest possible number of coins you need to spend to compress $s$.

### Examples

**input**
```
3 3 1
aba
```
**output**
```
7
```

**input**
```
4 1 1
abcd
```
**output**
```
4
```

**input**
```
4 10 1
aaaa
```
**output**
```
12
```

## Note

In the first sample case, you can set $t_1 =$ 'a', $t_2 =$ 'b', $t_3 =$ 'a' and pay $3 + 3 + 1 = 7$ coins, since $t_3$ is a substring of $t_1 t_2$.

In the second sample, you just need to compress every character by itself.

In the third sample, you set $t_1 = t_2 =$ 'a', $t_3 =$ 'aa' and pay $10 + 1 + 1 = 12$ coins, since $t_2$ is a substring of $t_1$ and $t_3$ is a substring of $t_1 t_2$.

# D. Power Tree

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

You are given a rooted tree with $n$ vertices, the root of the tree is the vertex $1$. Each vertex has some non-negative price. A leaf of the tree is a non-root vertex that has degree $1$.

Arkady and Vasily play a strange game on the tree. The game consists of three stages. On the first stage Arkady buys some non-empty set of vertices of the tree. On the second stage Vasily puts some integers into all leaves of the tree. On the third stage Arkady can perform several (possibly none) operations of the following kind: choose some vertex $v$ he bought on the first stage and some integer $x$, and then add $x$ to all integers in the leaves in the subtree of $v$. The integer $x$ can be positive, negative of zero.

A leaf $a$ is in the subtree of a vertex $b$ if and only if the simple path between $a$ and the root goes through $b$.

Arkady's task is to make all integers in the leaves equal to zero. What is the minimum total cost $s$ he has to pay on the first stage to guarantee his own win independently of the integers Vasily puts on the second stage? Also, we ask you to find all such vertices that there is an optimal (i.e. with cost $s$) set of vertices containing this one such that Arkady can guarantee his own win buying this set on the first stage.

### Input

The first line contains a single integer $n$ ($2 \le n \le 200\,000$) — the number of vertices in the tree.

The second line contains $n$ integers $c_1, c_2, \ldots, c_n$ ($0 \le c_i \le 10^9$), where $c_i$ is the price of the $i$-th vertex.

Each of the next $n - 1$ lines contains two integers $a$ and $b$ ($1 \le a, b \le n$), denoting an edge of the tree.

### Output

In the first line print two integers: the minimum possible cost $s$ Arkady has to pay to guarantee his own win, and the number of vertices $k$ that belong to at least one optimal set.

In the second line print $k$ distinct integers **in increasing order** the indices of the vertices that belong to at least one optimal set.

#### Examples

**input**

```
5
5 1 3 2 1
1 2
2 3
2 4
1 5
```

**output**

```
4 3
2 4 5
```

**input**

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

**output**

```
2 3
1 2 3
```

### Note

In the second example all sets of two vertices are optimal. So, each vertex is in at least one optimal set.

## E. The very same Munchhausen

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

A positive integer $a$ is given. Baron Munchausen claims that he knows such a positive integer $n$ that if one multiplies $n$ by $a$, the sum of its digits decreases $a$ times. In other words, $S(an) = S(n)/a$, where $S(x)$ denotes the sum of digits of the number $x$.

Find out if what Baron told can be true.

### Input

The only line contains a single integer $a$ ($2 \le a \le 10^3$).

### Output

If there is no such number $n$, print $-1$.

Otherwise print any appropriate positive integer $n$. Your number must not consist of more than $5 \cdot 10^5$ digits. We can show that under given constraints either there is no answer, or there is an answer no longer than $5 \cdot 10^5$ digits.

#### Examples

**input**

```
2
```

| output |
| --- |
| 6 |

| input |
| --- |
| 3 |
| **output** |
| 6669 |

| input |
| --- |
| 10 |
| **output** |
| -1 |

# F. Secret Letters

time limit per test: 2 seconds

memory limit per test: 512 megabytes

input: standard input

output: standard output

Little W and Little P decided to send letters to each other regarding the most important events during a day. There are $n$ events during a day: at time moment $t_i$ something happens to the person $p_i$ ($p_i$ is either W or P, denoting Little W and Little P, respectively), so he needs to immediately send a letter to the other person. They can send a letter using one of the two ways:

- Ask Friendly O to deliver the letter directly. Friendly O takes $d$ acorns for each letter.
- Leave the letter at Wise R's den. Wise R values free space, so he takes $c \cdot T$ acorns for storing a letter for a time segment of length $T$. The recipient can take a letter from Wise R either when he leaves his own letter at Wise R's den, or at time moment $t_{n+1}$, when everybody comes to Wise R for a tea. It is not possible to take a letter from Wise R's den at other time moments. The friends can store as many letters at Wise R's den as they want, paying for each one separately.

Help the friends determine the minimum possible total cost of sending all letters.

### Input

The first line contains three integers $n, c, d$ ($1 \leq n \leq 10^5$, $1 \leq c \leq 10^2$, $1 \leq d \leq 10^8$) — the number of letters, the cost of storing a letter for one time unit at Wise R's den and the cost of delivering a letter via Friendly O.

The next $n$ describe the events. The $i$-th of them contains an integer $t_i$ and a character $p_i$ ($0 \leq t_i \leq 10^6$, $p_i$ is either W or P) — the time the $i$-th event happens and the person the event happens to.

The last line contains a single integer $t_{n+1}$ ($0 \leq t_{n+1} \leq 10^6$) — the time when everybody comes to Wise R for a tea and takes all remaining letters.

It is guaranteed that $t_i < t_{i+1}$ for all $i$ from $1$ to $n$.

### Output

Print a single integer — the minimum possible cost of delivery of all letters.

#### Examples

**input**

```
5 1 4
0 P
1 W
3 P
5 P
8 P
10
```

**output**

```
16
```

**input**

```
10 10 94
17 W
20 W
28 W
48 W
51 P
52 W
56 W
62 P
75 P
78 P
87
```

**output**

```
916
```

### Note

One of optimal solutions in the first example:

- At time moment 0 Little P leaves the letter at Wise R's den.
- At time moment 1 Little W leaves his letter at Wise R's den and takes Little P's letter. This letter is at the den from time moment 0 to time moment 1, it costs $1$ acorn.
- At time moment 3 Little P sends his letter via Friendly O, it costs $4$ acorns.
- At time moment 5 Little P leaves his letter at the den, receiving Little W's letter which storage costs 4 acorns.
- At time moment 8 Little P leaves one more letter at the den.
- At time moment 10 Little W comes to the den for a tea and receives the two letters, paying 5 and 2 acorns.

The total cost of delivery is thus $1+4+4+5+2=16$ acorns.