COCI 2017/2018

Round #6, February 3rd

Tasks

Task	Time limit	Memory limit	Score
Davor	1 s	64 MB	50
Alkemija	1 s	64 MB	80
Mate	2 s	128 MB	100
Cover	1 s	64 MB	120
Kotrljanje	2 s	64 MB	140
Vrtić	2 s	256 MB	160
Total			650

After successfully conquering the South Pole, Davor is preparing for new challenges. Next up is the Arctic expedition to Siberia, Greenland and Norway. He begins his travels on 31 December 2018, and needs to collect *N* kunas (Croatian currency) by then. In order to do this, he has decided to put away *X* (*X* ≤ 100) kunas every Monday to his travel fund, *X* + *K* kunas every Tuesday, *X* + 2**K* every Wednesday, and so on until Sunday, when he will put away *X* + 6**K* kunas. This way, he will collect money for 52 weeks, starting with 1 January 2018 (Monday) until 30 December 2018 (Sunday).

If we know the amount of money *N*, output the values *X* and *K* so that it is possible to collect the **exact** money amount in the given timespan. The solution will always exist, and if there are multiple, output the one with the greatest *X* and smallest *K*.

INPUT

The first line of input contains the integer *N* (1456 ≤ *N* ≤ 145600), the number from the task.

OUTPUT

The first line of output must contain the value of *X* (0 < *X* ≤ 100), and the second the value of *K* (*K* > 0).

SAMPLE TESTS

input

```
1456
```

output

```
1
1
```

input

```
6188
```

output

```
14
1
```

input

```
40404
```

output

```
99
4
```

In ancient times, when alchemists were searching for gold, the world was familiar with a total of N distinct substances, denoted with 1 to N. During many years of hard work, searching for the secret formula, alchemists discovered a series of interesting regularities - *alchemical reactions*. In one reaction, it's possible to transform substance set $\{X_1, X_2, \ldots, X_L\}$ to another substance set $\{Y_1, Y_2, \ldots, Y_R\}$. For example, the substance set {1, 4, 5} might react once and create the new substance set {2, 6}.

Joško is a modern alchemist and has M distinct substances denoted with $A_1, A_2, \ldots, A_M$. He has an unlimited quantity of each substance from that set. Joško wants to know which substances he can create using a list of reactions of ancient alchemists, so he's asking you to help him solve this problem.

INPUT

The first line of input contains two integers N and M ($1 \le M \le N \le 100\ 000$), the numbers from the task.
The second line of input contains M integers A_i ($1 \le A_i \le N$), labels of the substances Joško has in the beginning.
The third line of input contains the integer K ($1 \le K \le 100\ 000$), the number of known reactions.
The following $3 \cdot K$ lines contain a list of reactions. Each reaction is described with 3 lines in the following way:

- The first line contains the integers L and R ($1 \le L, R \le N$).
- The second line contains L distinct integers X_i ($1 \le X_i \le N$).
- The third line contains R distinct integers Y_i ($1 \le Y_i \le N$).
- This describes the reaction with which the substance set $\{X_1, X_2, \ldots, X_L\}$ transforms into substance set $\{Y_1, Y_2, \ldots, Y_R\}$.

The sum of all L values won't exceed 100 000.
The sum of all R values won't exceed 100 000.

OUTPUT

The first line of output must contain the integer X, the number of obtainable substances.
The second line of output must contain X distinct integers B_i, sorted ascendingly, that represent the labels of the obtainable substances.

SCORING

In test cases worth 60% of total points, it will hold:

- $N, K \le 500$.
- The sum of all L values and the sum of all R values won't exceed 500.

SAMPLE TESTS

input

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

output

```
4
1 2 3 4
```

input

```
6 3
1 4 5
3
3 2
2 3 4
1 6
1 3
4
1 5 6
1 1
6
2
```

output

```
5
1 2 4 5 6
```

Clarification of the first test case:
There are 2 reactions.
The first reaction transforms substance set {1, 2} into substance set {3}.
The second reaction transforms substance set {1, 3} into substance set {4}.
Joško initially has substances from the set {1, 2}.
Using the first reaction, Joško can obtain substance 3, after which he has substances from the set {1, 2, 3}.
After that, using the second reaction, he can also obtain substance 4.

Clarification of the second test case:
Joško initially has substances from the set {1, 4, 5}.
Using the second reaction, it is possible to obtain substance 6, after which it is possible to apply the third reaction, giving substance 2.
The first reaction is impossible to apply because Joško doesn't have substance 3.

Little Mate got an array of lowercase letters from the English alphabet as a present from his parents. In order to have at least some use of such a clever present, he decided to use it for finding rhymes when writing his next song.

To find a specific rhyme, Mate wants to select a word of length *D* that ends with an array of characters *XY*, i.e. where the next to last letter is *X*, and the last *Y*. Mate's process of selecting a word is by first crossing out some letters in a given sequence, and then merging the letters he didn't cross out into a single word. He wants to know in how many different ways he can cross out the letters so that he meets the given conditions.

The selection of two words is considered distinct if the sets of positions of the crossed-out letters are different.

INPUT

The first line of input contains an array of lowercase letters of the English alphabet *S* ($2 \le |S| \le 2000$).
The second line of input contains the integer *Q* ($1 \le Q \le 500\,000$), the number of different rhymes for which Mate needs to select words.
Each of the following *Q* lines contains the integer *D* ($2 \le D \le |S|$) and an array of lowercase letters of the English alphabet *XY* from the task.

OUTPUT

The i^{th} out of *Q* lines must contain the required number of ways for the i^{th} rhyme. Since that number can be quite large, output only the value **modulo 1 000 000 007**.

SCORING

In test cases worth 40% of total points, it will hold $|S| \le 50$.
In test cases worth an additional 40% of total points, it will hold $|S| \le 200$.

SAMPLE TESTS

input

```
banana
3
2 na
3 ba
4 nn
```

output

```
3
0
1
```

input

```
malimateodmameitate
3
10 ot
7 aa
3 me
```

output

```
2
464
56
```

Clarification of the first test case:
Word of length 2 that ends with “na” can be obtained in the following ways:
~~b a n a~~ ***n a***, ~~b a~~ ***n a*** ~~n a~~, ~~b a~~ ***n*** ~~a n~~ ***a***.

You are given N points in the coordinate system. They need to be covered with one or more rectangles, such that the following conditions are met:

- The sides of each rectangle are parallel with the coordinate axes,
- The center of each rectangle is in the origin, i.e. point (0, 0),
- Each given point is located either inside of the rectangle or on its boundaries.

Of course, it is possible to cover all the points using only one rectangle, but this rectangle could have a very large surface area. Our goal is to find a selection of required rectangles such that the sum of their surface areas is minimal.

INPUT

The first line of input contains the integer N ($1 \le N \le 5000$), the number of points.
Each of the following N lines contains two integers X and Y ($-50\,000\,000 \le X, Y \le 50\,000\,000$, $XY \neq 0$), the coordinates of each point.

OUTPUT

You must output the required minimal sum of surface areas of the rectangles.

SCORING

In test cases worth 40% of total points, it will hold $N \le 20$.

SAMPLE TESTS

input	input	input
2 1 1 -1 -1	3 -7 19 9 -30 25 10	6 1 20 3 17 5 15 8 12 9 11 10 10
output	**output**	**output**
4	2080	760

Clarification of the first test case: We choose the rectangle whose opposite angles are the given points, since it meets the conditions from the task.
Clarification of the second test case: We choose two rectangles with their centers in the origin. The first is of dimensions 50 x 20 and covers point (25, 10). The second is of dimensions 18 x 60 and

covers the first two points. If we wanted to cover all the points using one rectangle, it would be of dimensions 50 x 60.

Vla-tko, Vla-tko, Vla-tko!

Nobody comes to Vlatko's office hours anymore. Angered, enraged and disgruntled, Vlatko's revenge is a convenient task for COCI:

You are given an infinite arithmetic sequence $A(n) = Cn + D$, defined for all natural numbers n. We want find a sequence of M distinct natural numbers $n_1, n_2, ..., n_M$ less than or equal to 10^{15} such that the corresponding members of sequence $A(n_1), A(n_2), ..., A(n_M)$ all have the same sum of digits in base B.

Please note: Every positive integer N can be written in base B as follows: create the unique string $x_k x_{k-1}...x_1 x_0$, where $0 \le x_i < B$ for each i, and the equation $x_k B^k + x_{k-1} B^{k-1} + ... + x_1 B + x_0 = N$ is satisfied. The sum of digits is given with $x_k + ... + x_0$.

INPUT

The first line of input contains four integers C, D, B and M ($1 \le C, D \le 10000$, $2 \le B \le 5000$, $1 \le M \le 250000$).

OUTPUT

The first and only line of output must contain the required numbers, separated by spaces, in an arbitrary order.
Please note: you must output the numbers n_i, not numbers $A(n_i)$. All numbers in the output should be less than or equal to 10^{15}.
The input data will be such that a solution that meets the given conditions exists.

SAMPLE TESTS

input	input
`5 3 2 2`	`2 1 10 3`
output	**output**
`2 5`	`2 20 200`

Clarification of the test cases:
In the first test case, one of the possible sequences is the sequence in the output. The corresponding members of the arithmetic sequence are 5 * 2 + 3 = 13 and 5 * 5 + 3 = 28. The format of number 13 in base 2 is 1101, whereas the format of number 28 in base 2 is 11100. The sum of digits in both formats is equal to 3.

In the second test case, the corresponding members of the sequence are 2 * 2 + 1 = 5, 2 * 20 + 1 = 41, and 2 * 200 + 1 = 401. Each of the numbers' digits, written in base 10, sum up to 5.

There are N children in a kindergarten, and each child considers one child to be their best friend. Children are quite unusual, so it holds that no two children consider the same child their best friend, but it is possible that a child is a best friend to themself! Additionally, if child B is best friend of child A, A is not necessarily best friend of child B.

The kindergarten teacher has N bags of candy that she wishes to distribute to the children such that each child gets exactly one bag. However, the problem is that the bags don't necessarily contain the same amounts of candy, so the children can become displeased. Since the children have a very developed sense of justice, the dissatisfaction of child A is equal to the absolute difference between the number of candy A and their best friend received.

The kindergarten teacher has decided to distribute the bags so that the maximal dissatisfaction of a child is as small as possible. Help her determine the optimal distribution of candy bags!

INPUT

The first line of input contains the integer N ($1 \le N \le 150$).
The second line of input contains N distinct integers, whereas the i^{th} number is the label of the best friend of the i^{th} child. The children are labelled with numbers from 1 to N.
The third line of input contains N integers, whereas the i^{th} number is equal to the number of candy in the i^{th} bag. The numbers won't exceed 10^9.

OUTPUT

The first line of output must contain the minimum possible maximal dissatisfaction of a child.
The second line of output must contain N numbers, separated by space, whereas the i^{th} number denotes the number of candy for the i^{th} child. If there are multiple optimal distributions, output any.

SCORING

In test cases worth 20% of total points, the best friend of the i^{th} child will be the the $(i+1)^{th}$ child for all $i < N$, and the best friend of the N^{th} child will be the first child.
In additional test cases worth 30% of total points, it will hold $N \le 20$.

SAMPLE TESTS

input

```
3
2 1 3
3 8 5
```

output

```
2
5 3 8
```

input

```
5
3 5 4 1 2
24 45 39 19 16
```

output

```
8
16 39 24 19 45
```

input

```
8
6 3 7 1 4 8 2 5
6 5 2 4 7 4 4 3
```

output

```
2
3 4 4 4 6 5 2 7
```