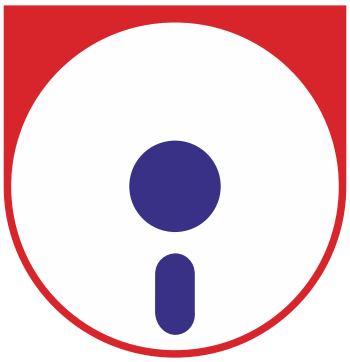


Croatian Open Competition in Informatics

Round 4, January 18th 2020

Tasks

Task	Time limit	Memory limit	Score
Pod starim krovovima	1 second	512 MiB	50
Spiderman	1 second	512 MiB	70
Holding	1 second	512 MiB	110
Klasika	1 second	512 MiB	110
Total			340

Task Pod starim krovovima

Setting: Legendary Zagrebian Inn called *Kod Žnidaršića*.

Time: The year 1936.

Plot summary: Franjo and his friends are discussing the current events in Abyssinia while enjoying a couple of drinks at the bar. His son, little Perica, is sitting at a small table in the corner of the bar. In front of Perica there are N glasses conveniently numbered from 1 to N. The volume (in nanoliters) of each glass is known as well as the amount of liquid that is currently inside it.

Problem: Little Perica wants to know what is the largest possible number of glasses that can be emptied by pouring the liquid between glasses. He can freely pour any integer number of nanoliters from one glass to another, as many times as he wants, as long as no liquid is spilled over.

Your task is to output the number of empty glasses along with one possible configuration of liquid in all glasses. If there are multiple configurations that yield the same number of empty glasses, output any of them. Note that it is not necessary to minimize the number of times liquid was poured between two glasses.

Input

The first line contains an integer N ($1 \leq N \leq 1\,000$) from the task description.

Each of the next N lines contains two integers T_i ($0 \leq T_i \leq 10^9$) and Z_i ($1 \leq Z_i \leq 10^9$) which, in that order, represent the current amount of liquid in the i-th glass and its volume. Both quantities are given in nanoliters and the current amount of liquid cannot be greater than the volume of the glass, i.e. $T_i \leq Z_i$ holds.

Output

In the first line you should output the largest number of glasses that can be emptied by pouring the liquid between glasses.

In the second line you should output the amount of liquid in each of the glass after Perica has performed the necessary pourings. The glasses should be ordered from glass numbered 1 to glass numbered N.

Scoring

Correctly written first line is worth 4 points, and correctly written second line is worth 1 point for each test case.

In test cases worth a total of 20 points, all glasses will have the same volume.

Examples

input

```
5
2 6
1 6
0 6
6 6
5 6
```

output

```
2
6 6 2 0 0
```

input

```
5
4 5
2 7
5 5
0 10
7 9
```

output

```
3
0 0 0 10 8
```

input

```
8
2 6
3 4
1 1
9 10
0 10
4 5
6 8
3 9
```

output

```
5
0 0 0 9 10 0 0 9
```

Clarification of the second example: One of the possible pouring configurations is the following:

1. pour everything from glass 1 into glass 2.
2. pour everything from glass 2 into glass 4.
3. pour four nanoliters from glass 3 into glass 4.
4. pour one nanoliter from glass 3 into glass 5.

Glasses numbered 1, 2 and 3 are now empty.

Task Spiderman

Little Ivan likes to play **Yamb** and read Marvel superhero comics. His favorite superhero is spider-man, a friendly neighbourhood teenager named Peter Parker who got his superpowers via a radioactive spider bite. Ivan fantasizes that one day he will be able to jump from one skyscraper to another, just like spider-man does in the comics. During one such fantasy, he fell asleep.

In his dream he was no longer named Ivan, his name was Peter Parkour and, you guessed it, he was able to use his parkour[1] skills to jump between skyscrapers. He quickly realized that there are exactly N skyscrapers in his surroundings and he somehow knew that i-th of those skyscrapers is h_i meters tall. He knows that he is able to jump from the i-th skyscraper to the j-th skyscraper if the remainder when dividing h_i with h_j is equal to K. Help Ivan determine for each skyscraper on how many other skyscrapers can he jump from it.

Input

The first line contains two integers N ($1 \leq N \leq 3 \cdot 10^5$) and K ($0 \leq K < 10^6$) from the task description.

The next line contains N integers h_i ($1 \leq h_i \leq 10^6$) from the task description.

Output

In one line output N space-separated integers such that the i-th of those integers represents the number of different skyscrapers on which Peter Parkour can jump on if he jumps from the i-th skyscraper.

Scoring

In test cases worth a total of 14 points, it will hold $1 \leq N \leq 2\,000$
In test cases worth an additional 14 points, there will be at most 2 000 skyscrapers of different heights.
In test cases worth an additional 14 points, it will hold $K = 0$.

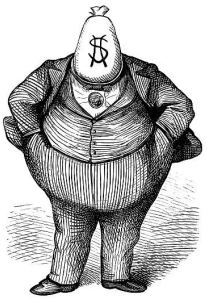
Examples

input	**input**	**input**
2 1 5 5	6 3 4 3 12 6 8 2	5 1 1 3 5 7 2
output	**output**	**output**
0 0	0 4 0 0 0 0	4 1 1 2 0

Clarification of the third example:
From the first skyscraper of height 1 Peter can jump on any other skyscraper.
From the second skyscraper of height 3 Peter can jump only on a skyscraper of height 2.
From the third skyscraper of height 5 Peter can jump only on a skyscraper of height 2.
From the fourth skyscraper of height 7 Peter can jump on skyscrapers of heights 2 and 3.
From the fifth skyscraper of height 2 Peter cannot jump on any other skyscraper.

[1] Internet sensation of 2004., it was in the Bond films, the goal is to get from point A to point B as creatively as possible.

Task Holding



Difficult times lie ahead of Ivica and his Holding – a group of N Croatian companies that are in his ownership. Each of these companies is in debt so the state sent its attorneys to take everything away from him. We have exclusively found out that Ivica managed to make a deal with the state to leave him certain companies in spite of the massive debt. Which ones? We found that out as well.

The state attorneys have laid out N proprietary papers of Ivica's companies. The debt of first company is written on the first paper A_1, the debt of the second is written on A_2, ... and the debt of the last company is written on the last paper A_N. Ivica made a deal with the state to leave the companies A_L, A_{L+1}, ..., A_R in his ownership, where L and R represent the positions in an array of papers on the table. Fortunately for Ivica, the attorneys are (also) corrupt. They will force him to take the same contignuos subarray as agreed upon (from L-th to R-th paper), but they will let him swap any two papers on the table for a specific cost. More precisely, swapping papers at positions i and j will cost him $|i-j|$ kunas (Croatian currency). Ivica is desperate. He has only K kunas in his pocket which he now wishes to spend in such a way that the sum of debts of companies he is left with is as small as possible.

Help Ivica achieve his goal.

Input

The first line contains four space-separated integers N, L, R ($1 \leq L \leq R \leq N \leq 100$) and K ($0 \leq K \leq 10\,000$) from the task description.

The second line contains N integers A_i ($0 \leq A_i \leq 10^6$) from the task description.

Output

You should output a single integer which represents the smallest amount of total debt Ivica will have if he spends his K kunas optimally.

Scoring

Subtask	Score	Constraints
1	22	$N \leq 13$ and $R = N$
2	33	$N \leq 50$ and $R = N$
3	33	$N \leq 50$
4	22	No additional constraints.

Examples

input

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

output

```
1
```

input

```
5 2 3 3
21 54 12 2 0
```

output

```
12
```

input

```
6 4 6 100
1 2 3 4 5 6
```

output

```
6
```

Task Klasika

In the beginning there was a node denoted as 1 and it represented the root of a tree. Your task is to support Q queries of the form:

- `Add x y` – Adds a new node to the tree as a child of node x. The newly added node and node x are connected with an edge of weight y. The newly added node is denoted by a number equal to the number of nodes that the tree consists of after its addition.
- `Query a b` – Finds the longest path in a tree which starts in node a and ends in some node from the subtree of node b (which itself is considered to be in its own subtree). The length of the path is defined as exclusive or (xor) of weights of all edges that the path consists of.

Input

The first line contains an integer Q ($1 \leq Q \leq 200\,000$) from the task description.

The i-th of the next Q lines contains the i-th query whose format corresponds to one of the queries from the task description. Values x, a and b will refer to an existing node at that moment and value y will not be greater than 2^{30}.

Output

You should output an answer to each query of type `Query`. Each answer should be printed in a separate line in the order in which corresponding queries appear in the input.

Scoring

Subtask	Score	Constraints
1	11	$Q \leq 200$
2	22	$Q \leq 2\,000$
3	33	In all queries of type `Query` it holds $b = 1$
4	44	No additional constraints.

Examples

input

```
4
Add 1 5
Query 1 1
Add 1 7
Query 1 1
```

output

```
5
7
```

input

```
6
Add 1 5
Add 2 7
Add 1 4
Add 4 3
Query 1 1
Query 2 4
```

output

```
7
2
```

input

```
10
Add 1 4
Add 1 9
Add 1 10
Add 2 2
Add 3 3
Add 4 4
Query 4 2
Query 1 3
Add 6 7
Query 1 3
```

output

```
14
10
13
```