Problem A. T-Shirts

Input file: `standard input`
Output file: `standard output`
Time limit: 1 second
Memory limit: 256 megabytes

Andrew and John are friends from different countries. They came to the International Olympiad of Metropolises.

To house all n participants of the Olympiad, the organizers have booked $\lceil \frac{n}{2} \rceil$ twin rooms in the hotel ($\lceil \frac{n}{2} \rceil$ means $n/2$ rounded up). Rooms are located one after another in a long hall and are numbered consequently starting with 1. Each room has two beds, denoted as bed 1 and bed 2. If the number of participants is odd, only bed 1 will be used in the last room.

To welcome the participants, the organizing committee has prepared t-shirts of k different colors, colors are numbered from 1 to k. Each participant should receive exactly one t-shirt. The t-shirts are placed on participants beds according to the following algorithm. In the room 1, the participant that occupies bed 1 gets t-shirt of color 1, the participant that occupies bed 2 get t-shirt of color 2, in the room 2 the participant at bed 1 gets t-shirt of color 3 (if there are at least 3 colors), and so on. Since the number of colors k can be less than the number of participants n, after the t-shirt of color k the t-shirt of number 1 is given away, then number 2, and so on.

When checking in to the hotel the participant can choose the room and the bed in that room. Andrew arrived first and chose the room and the bed. Now John has arrived. He can choose any room and any bed in it. He would like to get the t-shirt of the same color as Andrew. From among rooms that allow him to get such t-shirt he would like to choose the one as close to Andrew's as possible: the number of rooms between his room and Andrew's one should be minimum possible. If there are several such rooms, he would like to choose the room with maximum possible number.

Print the number of the room and the number of the bed in it that John should choose. If there is no way John can choose the room and the bed in it to get the t-shirt of the same color as Andrew, print `-1`.

Input

The first line of the input contains a single integer n ($2 \leq n \leq 10^9$) — the number of participants. The second line contains k ($2 \leq k \leq n$) — the number of different colors of t-shirts. The third line contains one integer — the number of the room that Andrew has chosen. The forth line contains one integer: 1 or 2 — the number of the bed in the room that Andrew has chosen.

Output

If John cannot choose the room and the bed to get the t-shirt of the same color as Andrew, print `-1` in the only line of the output.

Otherwise, print two integers: the number of the room and the number of the bed in that room John should choose. Keep in mind that if n is odd and John chooses the last room, he can only use bed 1 in that room.

Examples

standard input	standard output
25 2 1 2	2 2
25 13 7 1	-1

Note

The first sample test has two colors, so it is optimal for John to choose the room right after Andrew's one. In the second sample test Andrew is the only one to get t-shirt of color 13.

Scoring

In this problem, each test case is scored independently and costs 4 points. The solution must pass all sample tests to be tested on the main tests cases. However, the program that prints `-1` for all test cases, except sample tests, gets 0 points.

Group	Tests	Additional constraints	Comment
		n	
0	1 – 2	–	Sample tests.
1	3 – 15	$n \leq 100$	
2	16 – 27	–	

Problem B. Evacuation plan

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

The blitz contest of the Olympiad of Metropolises is going to take place in a building with a long hall containing n doors. The doors are consequently numbered from 1 to n and all distances between neighbouring doors (doors i and $i+1$, for all i from 1 to $n-1$) are equal. Some of the doors lead to the contest halls, while others are emergency exits from the building.

In this problem you have to design an evacuation plan that for each of n doors shows the exit from the building people should head to in case of a fire alert or other emergency. Plan is a sequence of integers $e_1, e_2, \ldots, e_n$, where e_i corresponds to the index of the door, that is assigned to the door i as the emergency exit. *Unreliability* of the plan is the number of pairs of doors, such that they are assigned the same emergency exit and they are located at the same distance to this exit. Formally, unreliability is equal to the number of pairs of indices $1 \le i < j \le n$, such that $e_i = e_j$ and $|e_i - i| = |j - e_j|$. Evacuation plan should be designed according to the following rules:

1. Each door i should be assigned one of the nearest emergency exits (it is easy to notice, that there might be no more than two nearest exits). Of course, if the door i is an exit itself, than $e_i = i$.
2. Among all plans that satisfy the first condition, the plan with minimum value of unreliability should be chosen. If there are several such plans, any of them is accepted.

Input

The first line of the input contains a single integer n ($2 \le n \le 100\,000$) — the number of doors in the hall. The second line contains n integers 0 and 1, where 0 denotes an emergency exit, while 1 stands for the door to the contest hall.

It's guaranteed, that there is at least one exit and at least one door that leads to the contest hall.

Output

The first line of the output should contain the value of unreliability of the optimal plan, i.e. the number of pairs of doors that are assigned the same exit an are located at the same distance to this exit.

The second line should contain any optimal evacuation plan $e_1, e_2, \ldots, e_n$.

Example

standard input	standard output
16 1 1 0 0 1 1 0 1 0 1 1 1 1 0 1 1	3 3 3 3 4 4 7 7 7 9 9 9 14 14 14 14 14

Note

In the sample test, the unreliability is provided by pairs 6 and 8, 12 and 16, 13 and 15.

Scoring

In this problem, each test case except sample is scored independently and costs 4 points. Sample test costs 0 points. Your solution will be judged on all tests even if it doesn't manage to pass sample test.

Group	Tests	Constraints	Comment
		n	
0	1	–	Sample test.
1	$2-9$	$n \le 200$	Each door has only one nearest exit.
2	$10-16$	$n \le 200$	
3	$17-26$	$n \le 100\,000$	

Problem C. Zebra

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Michael is fond of zebras, so he tries to find them everywhere. His grandmother asked him to paint the fence near the house and gave him unlimited amount of white and black paint. The fence can be seen as a sequence of posts. Some of them are already painted white or black, while others are yet uncolored. It's not allowed to change the color of already painted posts, but for others Michael is free to choose whether to paint it white or black. In this problem fence can be represented as a string, consisting of characters '`0`', '`1`' and '`?`', corresponding to a white post, a black post, or an uncolored post, respectively.

Michael considers the fence to look like zebra, if there exist two integers a and b ($a > 0$, $b \geq 0$), such that the first a posts of the fence are white, the following b posts are black, the following a posts are white again, then again follow b black posts, and so on. The last block is allowed to be incomplete. For example, fences represented by strings "`01101`" ($a = 1$, $b = 2$), "`000`" (a can be any positive integer, $b = 0$) and "`00110011`" ($a = 2$, $b = 2$) look like zebras, while "`01001`" and "`101010`" do not.

Michael wants to paint all uncolored posts in such a way that the fence will look like zebra for some integers a and b ($a > 0$, $b \geq 0$). If there are many such paintings, Michael wants to choose the one that has the maximum number of posts painted black. If such painting is still not unique, any of them is accepted.

Input

The only line of the input contains the string s ($1 \leq |s| \leq 300\,000$), consisting of characters '`0`', '`1`' and '`?`' only.

Output

If there is no way to paint uncolored posts in such a way that the resulting fence looks like zebra, print `-1` in the only line of the output. Otherwise, print any solution that has the maximum number of posts painted black. The painting should be printed as a sequence of '`0`' and '`1`', representing white and black posts, respectively.

Examples

standard input	standard output
0?	01
0110?	01101
10?	-1
011011	011011
101	-1

Note

Tests for this problem are divided into four groups. For each of the groups you earn points only if your solution passes all tests in this group and all tests in all **previous** groups.

Group	Tests	Points	Additional constraints	Comments
			$\|s\|$	
0	1 – 5	0	–	Sample tests.
1	6 – 25	20	$\|s\| \le 500$	
2	26 – 44	40	$\|s\| \le 5\,000$	
3	45 – 59	40	–	

Problem D. Database

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	256 megabytes

Head teacher of the Byteland school issued an order to control students' academic performance: each student is required to provide information about his grades at the end of each week. However, it is required to provide only the average grade, which is believed to completely describe the student's performance during the week.

Parents like this innovation, because now they can monitor the academic performance of their children and compare it to the performance of other students. Every Saturday students submit their average grades to the school database where they are stored. After that, parents perform m queries.

Let u be the maximum grade stored in the database at the current time. Let us denote as $cnt(x)$ the number of grades stored in the database, that are greater than or equal to x (there can be equal grades, each one is counted). Database supports four types of queries:

1. Replace all numbers stored in the database with the sequence $(cnt(1), cnt(2), \ldots, cnt(u))$.
2. Add integer x to the database.
3. Remove from the database a single occurrence of integer x (if there is at least one).
4. Count the number of elements equal to x.

Parents begin to query information they need and update the data only after all n students send their grades to the database.

Unfortunately, the school license for this database has just expired, so now you have to perform all the operations manually.

Input

The first line of the input contains two integers n and m ($1 \le n, m \le 200\,000$) — the number of students and the number of queries to perform, respectively.

The second line contains n integers g_i ($1 \le g_i \le 200\,000$) — the average grades of the students.

The following m lines describe the queries to the database in order they should be processed. Each description starts with one of the characters '`t`', '`a`', '`r`' or '`c`', meaning the query is of the first, the second, the third, or the fourth type, respectively. If the query is of the second, the third or the fourth type, the character is followed by an integer x_i ($1 \le x_i \le 200\,000$) — query parameter.

Output

First print the answers to all queries of the fourth type in order they appear in the input file. Then print in non-decreasing order all integers stored in the database after all queries are performed.

It's guaranteed that there would be at least one integer in the output.

Examples

standard input	standard output
6 8 4 3 3 3 6 6 t c 4 a 5 a 3 r 5 c 2 t r 3	0 2 3 3 5 7 7

Note

Let us consider the changes in the database for the sample test:

1. $(4, 3, 3, 3, 6, 6)$
2. $(6, 6, 6, 3, 2, 2)$
3. $(6, 6, 6, 3, 2, 2, 5)$
4. $(6, 6, 6, 3, 2, 2, 5, 3)$
5. $(6, 6, 6, 3, 2, 2, 3)$
6. $(7, 7, 5, 3, 3, 3)$
7. $(7, 7, 5, 3, 3)$

Scoring

Tests for this problem are divided into five groups. For each group you earn points only if your solution passes all tests of this group and all tests of some of the previous groups (see the table below).

Group	Tests	Points	Add. constraints	Required groups	Comments
			n, m, x_i		
0	1 – 1	0	–	–	Sample test.
1	2 – 29	15	$n, m, x_i \leq 200$	0	
2	30 – 58	15	$n, m, x_i \leq 3000$	0, 1	
3	59 – 74	35	–	–	All queries are of type 1 or 4.
4	75 – 111	35	–	0, 1, 2, 3	