Problem A. Jumping Machine

Time limit:	1 second
Memory limit:	512 megabytes

Young inventor has created a new jumping machine. In order to test it, he brought it to the testing polygon. The polygon is an infinite square grid.

Initially, the machine is located in the cell $(0, 0)$. The machine has n springs, the i-th spring has the force of l_i and allows the machine to jump l_i cells up or l_i cells to the right. Therefore this spring allows the machine to get from cell (x, y) either to cell $(x + l_i, y)$, or to cell $(x, y + l_i)$. After jumping, the spring is thrown back and cannot be reused. The machine can use the springs in any order.

During the tests the cells, that the machine will fly over, will be stained with machine oil. In order not to clean the grid after himself, the inventor has decided to put a protective mat on each cell the machine could potentially fly over.

Now the inventor is wondering how many protective mats he needs to bring to the test with him.

Input

The first line of input contains n — the number of springs that the machine has ($1 \le n \le 100$). The second line contains n integers l_i — the springs forces ($l_i \ge 1$; $1 \le l_1 + l_2 + \cdots + l_n \le 10^6$).

Output

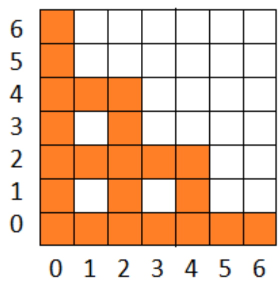
Output a single integer: the number of mats that inventor needs to bring.

Example

standard input	standard output
2 4 2	22

Explanation

All the cells that can get dirty when the machine jumps in the example test are colored orange one the figure below.



Cells that the machine can stain.

Problem B. Triangles and a Circle

Time limit: 1 second
Memory limit: 512 megabytes

You are given n distinct points on a circle of length L.

You need to find the number of triangles with vertices in these points that contain the center of the circle inside, or on their border.

Input

The first line of input contains two integers n and L ($3 \le n \le 300\,000$, $n \le L \le 10^9$).

Let's choose any point on the circle and call it S. Then any point A on the circle can be encoded as x, $0 \le x < L$: clockwise distance from S to A. We will call this number a coordinate of A.

The second line contains n distinct integers $x_1, x_2, \ldots, x_n$: coordinates of the given points on the circle ($0 \le x_i < L$).

Output

Print one integer: the number of triangles with vertices in the given points, that contain the center of the circle inside or on their border.

Examples

standard input	standard output
3 10 0 1 2	0
10 10 0 1 2 3 4 5 6 7 8 9	60

Problem C. Game

Time limit: 1 second
Memory limit: 512 megabytes

Petya was bored during the lockdown, so he came up with a new single player game that uses random numbers generator.

The game consists of several rounds, each round consists of one or more moves. Throughout the game Petya keeps track of his current score.

At the beginning of every round Petya has the score equal to n. Every move the generator outputs a non-negative integer and Petya tries to subtract it from his current score. If the result is non-negative, he changes his score to the result of the subtracation, otherwise, the result is ignored and the score does not change. For example, if the current score is 3, and the generator outputs 2, Petya does the subtraction and the score changes to 1. If the generator output is 5, the result is ignored and the score remains 3.

If the score after the current move is 0, the round ends, and at the beginning of the next move Petya is back to the score of n.

Lockdown had ended long ago, but Petya has suddenly came across a sheet of paper that contains a sequence of k integers —generator output throughout the game. The boy wonders how many rounds had he played and what was his current score when he stopped the game. Help him find it out using the notes on the sheet.

Input

The first line of input contains two integers: k — the number of moves Petya made, n — the score at the beginning of every round ($1 \leq k \leq 100\,000$, $1 \leq n \leq 10^8$).

The second line contains k integers — output of random numbers generator ($0 \leq a_i \leq 10^8$).

Output

The first line must contain one integer — the amount of played rounds.

The second line must contain one integer — the score at the end of the game.

If the last move of the game had ended the round, Petya didn't not begin a new round and his score was 0.

Example

standard input	standard output
4 3 1 2 4 1	1 2

Problem D. Fence

Time limit: 2 seconds
Memory limit: 512 megabytes

Donald owns a nice small house in Manhattan. Due to recent elections it is important to protect yourself from the potential public unrest, so Donald has decided to build a fence around his house.

Donald's house can be represented as a polygon on the plane, with all the coordinates being integers. Moreover, all of his house corners are exactly 90 deg, and each wall is parallel to either east-west or north-south axis. Donald wants to build a fence so that the house is completely inside of it and that the fence is not too close to the house. More precisely, Donald wants to build a fence in such way that Manhattan distance between any point of the fence and any point of the house is at least l.

Recall that Manhattan distance between points (x_1, y_1) and (x_2, y_2) is $|x_1 - x_2| + |y_1 - y_2|$.

Donald wants to minimize building costs, so he asks you to find the smallest possible length of the fence.

Input

The first line contains integers n and l ($4 \le n \le 100\,000$, $0 \le l \le 10^8$).

Each of the next n lines contains integers x_i, y_i ($|x_i|, |y_i| \le 10^8$), describing the border of the house in clockwise or counterclockwise order.

It's guaranteed that the house is non-degenerate, doesn't contain any self-intersections (no two segments intersect except the neighboring segments having a common end), no two points coincide, all the house walls are either vertical or horizontal.

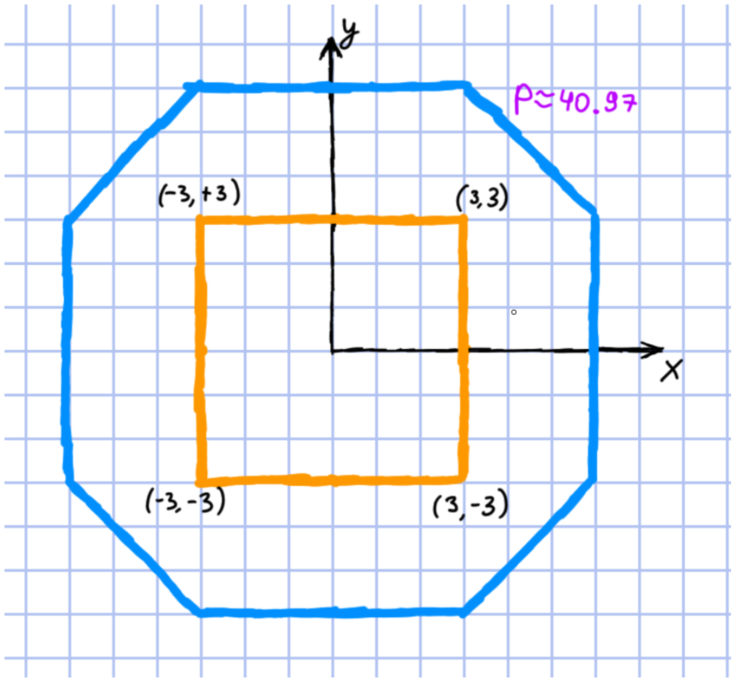
Output

Print a single real value, the smallest possible length of the fence. Your answer will be considered correct if it's absolute or relative error will be at most 10^{-6}.

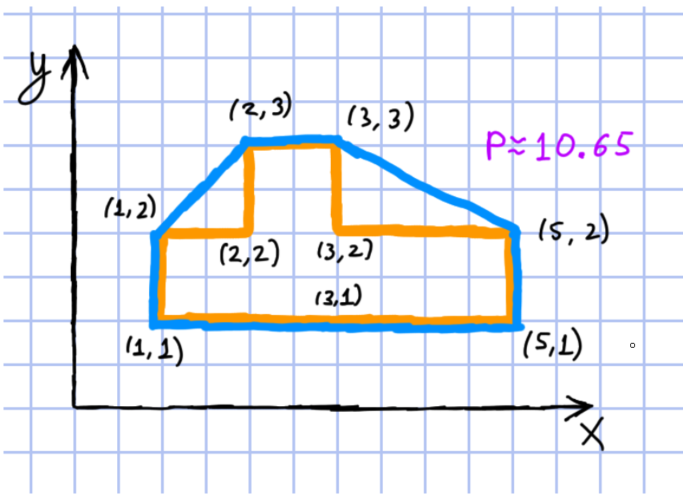
Examples

standard input	standard output
4 3 -3 -3 -3 3 3 3 3 -3	40.9705627485
9 0 1 1 3 1 5 1 5 2 3 2 3 3 2 3 2 2 1 2	10.6502815399

Explanations



Example 1, the house is shown inside in orange, and the optimal fence is shown outside in blue.



Example 2, the house is shown inside in orange, and the optimal fence is shown outside in blue.

Problem E. Flag with Stars

Time limit: 1 second
Memory limit: 512 megabytes

Andrew started playing a new multiplayer online game. He needs to create a flag to be different from other players.

Andrew decided that there should be n stars on the flag forming a figure just like on the US one:

- The stars should be arranged in horizontal rows, placed one below the other.
- The difference of number of stars in any two rows must not be greater than one.
- If there are two rows with different number of stars, then the number of stars in any two adjacent rows must be different.

Andrew doesn't want the flag to be too long or too wide, so he is interested in the minimum possible absolute difference of the number of rows and the maximum number of stars in a row.

Input

The only line of input contains an integer n — the number of stars ($1 \le n \le 10^{12}$).

Output

Output a single integer — the minimum possible absolute difference of the number of rows and the maximum number of stars in a row.

Examples

standard input	standard output
1	0
2	1
3	0
50	3

Explanation

An example of the optimal arrangement of the stars in the fourth test case:

Problem F. String Art

Time limit: 1 second
Memory limit: 512 megabytes

Dan and Sasha are creating and selling pictures in string art technique. A picture in this technique consists of n nails driven into a special board, m pairs of nails are connected by strings. To make the picture look as a whole, you can get from each nail to each other by strings.

Dan and Sasha want to produce string art kits, that would allow their customers to create a picture by themselves according to the instructions. Unfortunately, they found out that if you just send n nails, m strings and the final picture to a customer, many customers can't do it. So, they decided to sell *templates* for the pictures.

A template for a picture consists of m strings connecting beads. The strings connect the beads in such way that there is exactly one path along the strings from any bead to any other. Each bead has some color. To get a picture from the template, the customer lays the template down on the board so that the beads of the same color are at one point, and then nails them down. The picture originally conceived by the artists should be the result.

Dan and Sasha have developed a very beautiful picture, and want to make a template for it now. Help them!

Input

The first line of input contains two natural numbers n and m ($1 \le n \le 10^5$, $1 \le m \le 2 \cdot 10^5$) — number of nails on the picture and number of strings on it.

Each of the following m lines contains two integers u and v each ($1 \le u, v \le n$) — indices of nails connected by the corresponding string. No pair of nails is connected by more than one string and no nail is connected by a string to itself. Each nail can be reached from any other one by strings.

Output

Print the description of the picture template.

The first line of output should contain one integer c — number of beads in the template.

The second line of output should contain c integers $a_1, a_2, \ldots, a_c$ ($1 \le a_i \le n$) — colors of beads, the beads of color k will be nailed to the board with the k-th nail of the picture described in the input.

Each of the following m lines should contain two integers, beads connected by the corresponding string. There must be exactly one path from any bead to any other bead along the strings.

If there are several suitable templates, print the description of any of them.

Examples

standard input	standard output
3 2 1 2 2 3	3 1 2 3 2 3 1 2
5 5 1 2 2 3 1 4 3 4 4 5	6 1 2 3 4 1 5 4 5 4 6 3 4 2 3 1 2

Problem G. Ice Cream

Time limit: 1 second
Memory limit: 512 megabytes

Recently Makar has got n ice cream cones as a gift, the i-th of them contains a_i grams of the ice cream. He has decided to eat all of them today.

Before starting to eat, Makar takes the ice cream out of the freezer, so at the same moment the ice cream in each cone starts to melt. Each cone of ice cream is continuously melting at a rate of v grams per second. Makar never eats the melted ice cream, and it doesn't bothers him in any way: you can assume that the ice cream melts from the bottom, and Makar eats it from the top. Makar eats ice cream continuously at a rate of u grams per second. Makar can eat only from one cone at a time. But he can start with any cone and at any moment he can switch from one cone to another, switching takes no time.

Once started, Makar will continue eating until there's no ice cream left. But Makar knows that eating a lot of ice cream is unhealthy! Therefore, he wants to eat ice cream in a way that minimizes the total weight of the ice cream eaten.

Help Makar! Output the minimum total weight of ice cream that he can eat under the given conditions.

Input

The first line contains three integers n, v, u — the number of ice cream cones, the melting rate and the rate of eating ice cream ($1 \le n \le 3 \cdot 10^5$, $1 \le v, u \le 10^9$).

The second lines contains n integers a_i ($1 \le a_i \le 10^9$) — weight of ice cream in grams in each of the cones.

Output

Output a single real number — the minimum weight of the ice cream that can be eaten by Makar.

Your answer will be considered correct if its absolute or relative error doesn't exceed 10^{-6}.

Examples

standard input	standard output
1 1 2 90	60.000000
2 1 1 30 20	16.666667

Explanations

In the first test case, Makar eats ice cream for 30 seconds. During this time he manages to eat 60 grams and 30 grams melt, after that there is no ice cream left.

In the second test case, the optimal order is to eat from the second cone during first $\frac{10}{3}$ seconds and then eat from the first cone during next $\frac{40}{3}$ seconds.

Problem H. Perfect Round Dance

Time limit: 1 second
Memory limit: 512 megabytes

The kindergarten founded by Finley Marlin is attended by exactly $2n$ children. Today they have a party and the kids will dance around the large palm tree in the center of the room. There are young kids involved, so there are some restrictions on how the event would be organized.

For example, every kid has the best friend, and every kid is also the best friend of his best friend. If we consider pairs of best friends, they will be kids with numbers $2i-1$ and $2i$. Kids refuses to participate in the dance if they are not standing next to their best friend.

The kid number i came to the party wearing outfit x_i, but there can be some identical outfits worn by different children. So if two kids are not best friends and they wear the same outfits, they refuse to stand next to each other. Friendship is stronger than fashion, so best friends agree to stand next to each other even if they wear the same outfit.

Please help the tired teachers to place as much children as possible into the circle so that all the demands of children standing in circle are satisfied.

Input

The first line of input contains one integer n — the number of pairs of children ($1 \le n \le 300\,000$).

Each of the following n lines contains two integers: the i-th line contains x_{2i-1} and x_{2i} — the outfits worn by the $(2i-1)$-th and the $2i$-th kids respectively ($1 \le x_{2i-1}, x_{2i} \le 2n$).

Output

The first line of output must contain k — the maximum number of pairs of children that can form the circle. Even one pair can form a circle.

The next line should contain space-separated numbers of children in the circle in the order they are standing.

If there are several optimal answers output any of them.

Examples

standard input	standard output
3 1 1 1 2 1 3	2 3 4 5 6
4 1 2 3 4 4 2 1 3	4 1 2 3 4 6 5 7 8

Problem I. Walk of Three

Time limit: 1 second
Memory limit: 512 megabytes

The city where Vasya lives has a park with n lawns connected by m paths. One can walk in both directions along each path. The lawns connected by the path are called neighbors.

The entrance to the park is near the lawn number one which will be called the entrance lawn. Vasya's parents are very concerned about his safety, so they allow him to play only on the lawn that is a neighbor to the entrance lawn. Entrance lawn is usually overcrowded, so Vasya can't play on it.

Vasya finds it boring to simply walk along the path to the neighbor lawn. Instead, he starts at the entrance lawn, and walks along exactly three different paths. After that he plays on the lawn where he ends his walk. Vasya does not break the rules set by the parents, so he always ends his walk on the lawn neighboring to the entrance lawn.

Every day Vasya wants to choose a new walk he hasn't taken before. Help him to determine how many ways are to begin his journey at the entrance lawn, follow exactly three different paths, and find himself on the lawn neighboring to the entrance lawn.

Input

The first line of input contains two integers n and m — the number of lawns and the number of paths, respectively ($1 \le n \le 100\,000$, $1 \le m \le 200\,000$).

The next m lines contain pairs of lawns connected by paths. Any two lawns are connected by no more than one path. There are no paths connecting a lawn to itself.

Output

Print the number of walks that Vasya can take.

Examples

<table>
<tr><th>standard input</th><th>standard output</th></tr>
<tr><td>10 14
1 5
2 5
5 6
2 3
1 3
2 4
4 6
1 6
1 7
7 8
8 1
1 10
9 10
9 8</td><td>4</td></tr>
<tr><td>3 3
1 2
2 3
3 1</td><td>0</td></tr>
</table>

Problem J. Boring Lesson

Time limit: 1 second
Memory limit: 512 megabytes

Ildar is attending a boring online lesson. In order to do something, he transforms strings. Initially, he has a string s. Ildar wants to get a string t from the string s in minimum number of steps. In one step he can:

- Remove a character from any position.
- Insert any character to any position. I.e. before the first character, between two adjacent characters, or after the last character.
- Replace character at any position with any other character.

The minimum number of such steps needed to transform string s into string t is also known as *edit distance* between s and t.

Ildar has n favorite strings w_i. Consider sequence of strings that would occur during the transformation: $s = x_1, x_2, \ldots, x_{m-1}, x_m = t$. Ildar wants as many of w_i as possible to appear in the set $\{x_1, x_2, \ldots, x_m\}$. Help Ildar to find out what is the minimum number of steps needed to transform s to t, and what is the maximum number of w_i that can appear during this process, also print these strings.

Input

The first line of input contains the string s.

The second line of input contains the string t.

The third line contains a single integer n ($0 \le n \le 1\,000$). The following n lines contain strings w_i.

All strings consist of lowercase English letters, are non-empty, their lengths don't exceed 10 000. The total length of all strings doesn't exceed 10 000. All strings are distinct, including $s \ne t$, $s \ne w_i$ and $t \ne w_i$.

Output

Output two integers at the first line of output — the minimum number of steps, needed to transform s into t, and the maximum number of strings w_i that can appear in the process of transformation.

After that, output strings w_i that can appear during the transformation, in the same order they would appear. If there are multiple correct answers, you can output any of them.

Examples

<table>
<tr><th>standard input</th><th>standard output</th></tr>
<tr><td><pre>cat
dog
4
dot
pot
rat
oat</pre></td><td><pre>3 1
dot</pre></td></tr>
<tr><td><pre>longlong
double
3
doublon
longleng
dongle</pre></td><td><pre>6 2
longleng
dongle</pre></td></tr>
</table>

Explanation

In the second example one of correct transformations is the following:

"longlong" → "**longleng**" → "dongleng" → "dongleg" → "**dongle**" → "donble" → "double"

Ildar's favorite strings are highlighted.

Problem K. Checkers

Time limit: 1 second
Memory limit: 512 megabytes

Dima is bored of playing checkers with himself. Since there is nothing but checker pieces to play with, he came up with the following game.

Each piece he has is either white or black. Dima builds a tower by stacking his pieces on top of each other in some order. A *black stripe* is a sequence of adjacent black pieces, with either a white piece, or the end of the tower at the bottom and top of it. In other words, two adjacent black pieces always belong to the same black stripe. The goal of the game is to get the maximum number of black stripes in the tower.

The game has just started. Dima has a white and b black pieces. What is the maximum number of black stripes he can get in his tower?

Input

The only line of input contains two integers a and b — the number of white and black pieces, respectively ($0 \le a, b \le 10^{18}$).

Output

Output a single integer — the maximum possible number of black stripes.

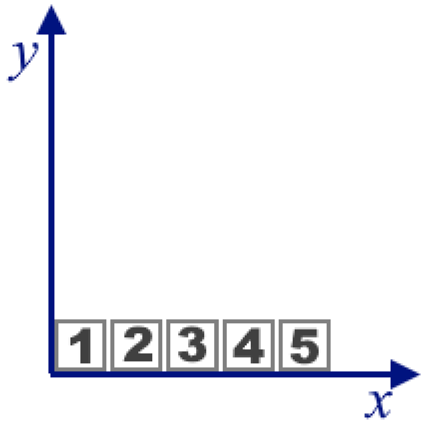
Examples

standard input	standard output
1 2	2
5 2	2
0 3	1

Problem L. Magnets

Time limit: 3 seconds
Memory limit: 512 megabytes

You have a $10^9 \times 10^9$ square magnetic board with the origin of the coordinate system in the lower-left corner. There are n magnets on the board, numbered from 1 to n. Each magnet is an 1×1 square. Initially, the magnets are positioned in such way that the lower right corner of the i-th magnet has the coordinates $(i, 0)$.

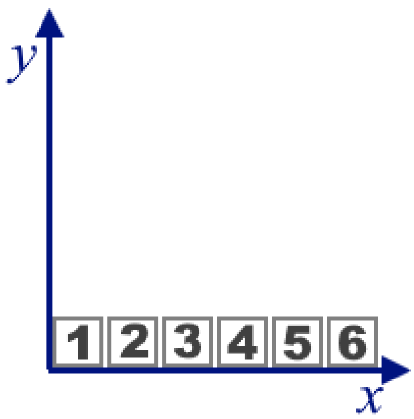


Example of the initial state for $n = 5$

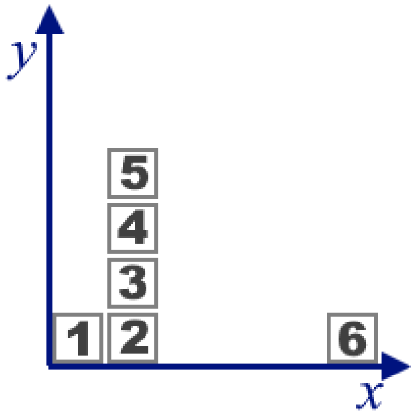
You are receiving q queries of two types:

- a query of type 1 is characterized by two integers l and r ($1 \le l \le r \le n$): take magnets with numbers from l to r inclusive, and rotate them by 90°. If the selected magnets formed a horizontal segment, then the rotation should be performed counterclockwise by 90°, so they will turn into a vertical segment. If the selected magnets formed a vertical segment, then the rotation should be performed clockwise 90°, so they will turn into a horizontal segment. All turns are relative to magnet with the smallest number. In this query, it is guaranteed that magnets with numbers from l to r form a continuous horizontal or vertical segment at the time of query processing.
- a query of type 2 is characterized by one integer j ($1 \le j \le n$): output the coordinates (x, y) of the lower right corner of the magnet with the number j.

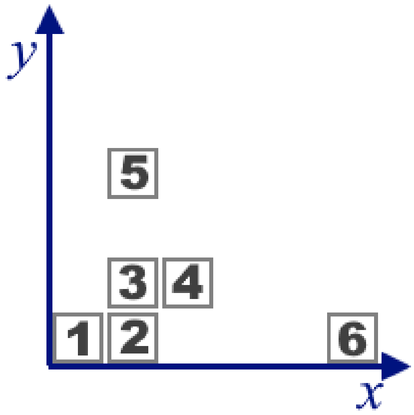
Below are the board states for $n = 6$ and the series of first type queries $(l_1 = 2, r_1 = 5)$, $(l_2 = 3, r_2 = 4)$, $(l_3 = 2, r_3 = 3)$, $(l_4 = 6, r_4 = 6)$.



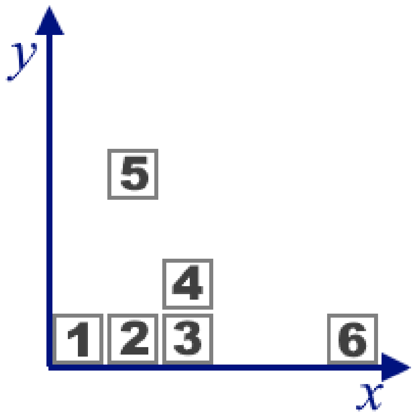
Initial state for $n = 6$.



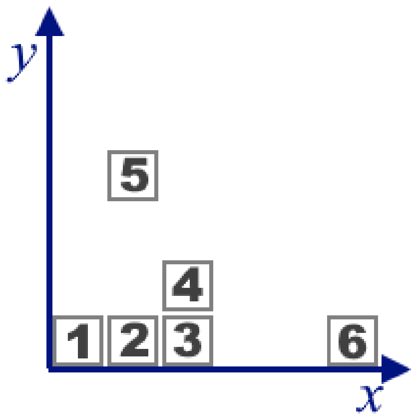
After processing a query of the first type ($l_1 = 2, r_1 = 5$).



After processing a query of the first type ($l_2 = 3, r_2 = 4$).



After processing a query of the first type ($l_3 = 2, r_3 = 3$).



After processing a query of the first type ($l_4 = 6, r_4 = 6$).

For each query of type 2 you should output the coordinates of the lower right corner of the magnet with the corresponding number.

Input

The first line contains two integers n and q ($1 \le n, q \le 2 \cdot 10^5$) — the number of magnets on the board and the number of queries, respectively.

Each of the following q lines contains one query of either type 1 or type 2. A type 1 query consists of 3 integers $1\ l\ r$ ($1 \le l \le r \le n$), a type 2 query consists of 2 integers $2\ j$ ($1 \le j \le n$).

Output

For each query of the type 2 output x and y — coordinates of the lower right corner of the magnet with the number j at the moment of processing the corresponding query.

Examples

standard input	standard output
6 8 1 2 5 2 5 1 3 4 2 4 1 2 3 2 6 1 6 6 2 1	2 3 3 1 6 0 1 0
7 7 1 3 6 1 3 4 1 5 6 2 3 2 4 2 5 2 6	3 0 4 0 3 2 4 2