Problem A. Cycles with Common Vertex

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

Recently Ksyusha bought N graphs, the i-th of them is a chain consisting of c_i vertices (see the definition below). In addition to them, Ksyusha is a happy owner of the Super-vertex. Ksyusha added edges from the endpoints of each chain to the Super-vertex. As a result, she obtained N cycles intersecting in Super-vertex, the i-th of these cycles consists of $(c_i + 1)$ vertices.

Ksyusha decided to color each vertex of her graph into either black or white. She calls a graph good if the shortest distance between any two vertices colored black is greater than or equal to K. Now Ksyusha is wondering what is the maximum number of vertices that can be colored black so that the graph would still remain good?

Input

The first line contains two integers N and K ($1 \le N \le 100\,000$, $2 \le K \le 100\,000$) which denote the number of chains and the restriction on the distance between vertices colored black. The next line contains a sequence of N integers c_i ($K \le c_i \le 10^9$) which denote the lengths of chains.

Output

Print the maximum number of vertices that can be colored black.

Examples

Standard input	Standard output
2 3 3 3	2
2 3 6 9	5

Note

A chain consisting of V ($V > 1$) vertices is a graph where all vertices except two have degree 2. The remaining two vertices have degree 1 and are called the endpoints of the chain.

Problem B. Remainders

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

Little Petya likes maths very much. Recently he learned about integer division with remainder at the math lesson. He received the following task as homework: given the numbers a_1, a_2, ..., a_n one needs to evaluate the expression

$$(\ldots((a_1 \bmod a_2) \bmod a_3) \ldots \bmod a_{n-1}) \bmod a_n.$$

Here, $a \bmod b$ denotes the remainder of division of a by b. Petya wrote down the numbers a_i, however he forgot the order in which they were given. So he decided to evaluate the expression written above for all $N!$ permutations of numbers a_i and let the teacher choose the correct one. Soon he realized that the number of permutations might be very large and he is unable to finish the task before the next math lesson. Luckily, the number of possible results of the expression written above is not that large. So Petya decided to find all the numbers that can be equal to the value of his expression for some permutation of a_i. Help him find the amount of such numbers.

Input

The first line of input contains an integer N ($2 \le N \le 100$) which is the amount of numbers in Petya's expression. The second line contains N space-separated positive integers not exceeding $3 \cdot 10^5$.

Output

Output the number of different possible results of Petya's expression.

Examples

Standard input	Standard output
4 5 6 7 8	4
3 10 7 10	3
5 34 20 199 22 135	16

Note

In the first example, the possible results of the expression are 1, 2, 3 and 5.

In the second example, only three permutations of a_i are possible. All of them lead to different results:

$$(7 \bmod 10) \bmod 10 = 7,$$

$$(10 \bmod 7) \bmod 10 = 3,$$

$$(10 \bmod 10) \bmod 7 = 0.$$

Problem C. Rectangles and Connected Regions

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

Little Petya likes rectangular tables very much. Recently he has received a table consisting of N rows and M columns as a gift from his mother. Each cell of the table is either black or white. The only thing Petya likes more than tables is playing with little Masha. She suggested him to play a game with his new table. The game consists of Q rounds. In each round, Masha chooses a rectangle in the table, and Petya tells her the number of connected regions of cells of the same color in this rectangle (see the definition below). Taking into account the fact that the children can only count to two, *all numbers greater than two are indistinguishable for them* (see the samples for further clarification). Your task is to help Petya answer all Masha's questions.

Two cells of the same color are considered to be in the same connected region inside the given rectangle if there exists a path starting in the first cell and ending in the second one that satisfies the following properties:

- All cells of the path are of the same color.
- Every two subsequent cells on this path share a side.
- All cells of the path belong to the given rectangle.

Input

The first line contains two integers N and M ($1 \le N \le 2000$, $1 \le M \le 2000$) which denote the number of rows and columns in the table, respectively. The next N lines contain M characters each and denote Petya's table. Character "`1`" stands for a black cell, and character "`0`" stands for a white cell.

The next line contains an integer Q ($1 \le Q \le 500\,000$) indicating the number of Masha's questions. Each of the next Q lines contains four integers r_1, c_1, r_2 and c_2 ($1 \le r_1 \le r_2 \le N$, $1 \le c_1 \le c_2 \le M$) where (r_1, c_1) and (r_2, c_2) are the coordinates of the two opposite corners of rectangle from the current Masha's question.

Output

You must output Q lines, i-th of them must contain the answer for the i-th Masha's question. The questions are numbered in the order they appear in the input. **If the answer for some question is greater than or equal to 3, you must output 0 instead.**

Examples

Standard input	Standard output
4 5 01011 10101 01011 00001 5 1 1 2 3 3 1 4 3 3 3 4 5 1 5 4 5 1 4 4 5	0 2 2 1 0
5 5 11111 11111 11111 11101 11111 3 1 1 3 3 1 1 5 5 3 3 5 5	1 2 2

Problem D. Inversions

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

Little Petya likes permutations very much. The only thing he likes more than permutations is playing with little Masha. She has a birthday soon, and Petya decided to present her a permutation. He knows that K is her favorite number. So, he decided that the permutation he is going to present must contain exactly K inversions (see the definition below). Among all permutations with K inversions, Petya wants to choose the one that contains the smallest number of elements. If there are still several possible permutations, Petya will choose the lexicographically smallest one. Help him to find the desired permutation.

A *permutation* is an ordered arrangement of the set of numbers 1, 2, $\ldots$, N in which each of these numbers occurs exactly once. In the following definitions, $\pi(i)$ stands for the number located in the i-th position of the permutation π.

An *inversion* in a permutation π of numbers $1, 2, \ldots, N$ is a pair of indices (i, j) such that $1 \le i < j \le N$ and $\pi(i) > \pi(j)$.

A permutation π is considered to be lexicographically smaller than permutation σ if the following two statements hold for some index j $(1 \le j \le N)$:

- $\pi(j) < \sigma(j)$;
- $\pi(i) = \sigma(i)$ for each i from 1 to $j - 1$, inclusive.

Input

Input contains an integer K $(0 \le K \le 1\,000\,000\,000)$ which is the desired number of inversions in the permutation.

Output

The first line of output must contain the number N of elements in the desired permutation. The second line must contain N integers separated by spaces, which denote the permutation Petya is looking for.

Examples

Standard input	Standard output
0	1 1
1	2 2 1
2	3 2 3 1
3	3 3 2 1

Problem E. Points

Input file:	`Standard input`
Output file:	`Standard output`
Time limit:	2 seconds
Memory limit:	256 mebibytes

You are given three pairwise non-collinear vectors $\vec{a} = (a_x, a_y)$, $\vec{b} = (b_x, b_y)$, $\vec{c} = (c_x, c_y)$ and an integer number N. Find the number of distinct points p such that $p = u_a \cdot \vec{a} + u_b \cdot \vec{b} + u_c \cdot \vec{c}$, where the numbers u_a, u_b and u_c are integers and $0 \le u_a, u_b, u_c \le N - 1$. Two points $p = (p_x, p_y)$ and $q = (q_x, q_y)$ are considered distinct if $p_x \ne q_x$ or $p_y \ne q_y$.

Input

The first line contains a single integer N ($1 \le N \le 2000$). Six integers are listed in the second line: a_x, a_y, b_x, b_y, c_x, c_y ($1 \le a_x, a_y, b_x, b_y, c_x, c_y \le 1000$).

Output

In a single line you must output the desired number of points.

Examples

Standard input	Standard output
5 2 1 1 2 3 3	61
5 10 1 5 5 1 10	125
2 2 3 1 2 1 1	7

Problem F. Permutation Cube

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

Recently Ksyusha installed the game "Permutation Cube" on her computer. The rules are the following. At the beginning, three permutations X_i, Y_i and Z_i of the set 1, 2, ..., N are generated. On the each move, the player can perform one of two actions:

- Move the cursor to an arbitrary point (u, v, t) where $1 \le u, v, t \le N$. The player must pay a fee of 1 coin.
- If the current cursor position is (u, v, t), move the cursor to the point (X_u, Y_v, Z_t) for free.

The aim of the game is to visit all N^3 points (u, v, t) such that $1 \le u, v, t \le N$. At the beginning, the cursor is not placed anywhere. Find the minimum number of coins that Ksyusha will need to pay in order to win.

Recall that a *permutation* is an ordered arrangement of the set of numbers 1, 2, ..., N in which each of these numbers occurs exactly once.

Input

The first line contains an integer N, the size of playing field ($1 \le N \le 30\,000$). The next three lines contain permutations X_i, Y_i and Z_i, one per line. It is guaranteed that each of these lines contains a valid permutation of the numbers 1, 2, ..., N. Consecutive elements of each permutation are separated by spaces.

Output

Print the minimum number of coins needed to be paid in order to win the game.

Examples

Standard input	Standard output
3 1 2 3 3 1 2 2 1 3	6
3 1 3 2 2 3 1 3 1 2	6