Problem A. Two snails (1st Division Only!)

Input file:	`A.in`
Output file:	`A.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

There is a rectangular field consisting of M rows and N columns. The snail has traversed this field by spiral clockwise starting from upper left corner. At that all cells has been consecutively numbered in order of traversal by numbers 1, 2, 3,. . ..

Now the other snail is appearing on this field in a cell (i_1, j_1). It is necessary for him to reach a cell (i_2, j_2). Each second the snail can move into adjacent cell by horizontal or by vertical on condition that the number of this cell differs from the number of previous cell on at most k.

Your task is to determine how long the travel of second snail takes.

Input

The input file contains integer numbers M, N, k, i_1, j_1, i_2, j_2 ($1 \le M, N \le 10^{18}$, $1 \le k \le 2 \cdot 10^{18}$, $1 \le i_1, i_2 \le M$, $1 \le j_1, j_2 \le N$).

Output

In the output file write one integer number: the minimal time needed for second snail to reach required cell.

Examples

A.in	A.out
3 5 1 1 2 3 4	6
5 5 7 3 1 3 3	4

Problem B. Triangular room (1st Division Only!)

Input file:	`B.in`
Output file:	`B.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

Many books on entertaining mathematics contain following task. *Arrange 3 chairs around the perimeter of triangular room such that there would be 2 chairs near each wall. The solution of this problem is to put one chair in each corner of the room.*

Consider more general problem. Let the room is represented by triangle ABC. The total number of chairs n, the number of chairs n_{AB}, which must be standing near wall AB, the number of chairs n_{BC}, which must be standing near wall BC, and the number of chairs n_{AC}, which must be standing near wall AC are given. It is necessary to find the number of arrangements satisfying conditions. Chairs can be put in corners of the room or along walls only, and should not be put in the center of the room. In each corner you can put any number of chairs.

Input

The input file contains integer numbers n, n_{AB}, n_{BC}, n_{AC} ($0 \le n, n_{AB}, n_{BC}, n_{AC} \le 10^{18}$).

Output

Write the number of different chairs arrangements in first line of the input file. If there is at least one arrangement, write 6 nonnegative integer numbers in the second line: k_A, k_{AB}, k_B, k_{BC}, k_C, k_{AC}, represented number of chairs, which must be put in the corner A, along the wall AB, in the corner B, along the wall BC, in the corner C and along the wall AC respectively.

Examples

B.in	B.out
`3 2 2 2`	`1` `1 0 1 0 1 0`
`3 3 2 2`	`0`

Problem C. S-Grundy game (1st Division Only!)

Input file:	C.in
Output file:	C.out
Time limit:	2 seconds
Memory limit:	256 megabytes

Let S is a certain set of nonnegative integers. Let us construct a sequence $G_S(n)$ $(n > 0)$ using the formula

$$G_S(n) = \mathrm{mex}\{G_S(x) \text{ xor } G_S(y) : x, y > 0,\ x + y = n,\ |x - y| \notin S\},$$

where $\mathrm{mex}\, A$ is the least nonnegative integer which does not belong to the set A, and a xor b is a result of bitwise addition of numbers a and b modulo 2.

A set S well be called beautiful, if $G_S(n + 4) = G_S(n)$ when $n > 4$, and values $G_S(n)$ are equal $0, 0, 0, 1, 0, 2, 1, 3$ when $n = 1, 2, 3, 4, 5, 6, 7, 8$ correspondingly.

You are given $n \geq 0$ and required to find the number of beautiful sets with elements not exceeded n, and yields this number modulo $10^9 + 7$.

Input

The only line of the input file contains a nonnegative integer $n \leq 10^{18}$.

Output

In the output file you should write the answer of the task.

Examples

C.in	C.out
0	0
1	1
2	1
3	1
4	1

Problem D. Get equal (1st Division Only!)

Input file:	`D.in`
Output file:	`D.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

On the table there are cards. On each card it is written some number. Moreover, there is a quite large stack of empty cards. For one turn, it is allowed take away from the table two cards with equal numbers, then take two empty cards from stack, write a number on each of them and put them on the table.

It is required to determine how to make in minimal number of turns the equal numbers were written on all cards on the table.

Input

The first line contains the number of cards N on the table ($1 \le N \le 30000$). The second line consists of N numbers, written of cards. All numbers is positive integer and does not exceed 10^9.

Output

On the first line output the minimal number of operations L, which necessary to get all equal cards on the table. On each of following L lines output four numbers describing corresponding turn: first and second ones are numbers on taken off cards, third and fourth ones are numbers written on new cards. If it is impossible to get all equal cards, output the only number -1.

Examples

D.in	D.out
3 1 2 2	1 2 2 1 1
6 3 3 3 4 4 4	2 3 3 4 3 3 3 4 4

Problem E. Jumps on strip (1st Division Only!)

Input file:	`E.in`
Output file:	`E.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

The horizontal strip $1 \times N$ is divided into cells of size 1×1. In the cell with number s there is a checker piece. In the first turn, a piece should move one cell (left or right). Second move should be made through two cells, etc. Each next move should be greater than previous one by 1. So it has been continued while a checker piece has moves not overstepping the bounds of strip.

Your task is to determine maximal and minimal numbers of moves that a piece can move.

Input

The first line of the input file contains the number of test cases T ($1 \le T \le 20$). Each of following T lines consists of two integer numbers N и s ($1 \le N \le 10^{18}$, $1 \le s \le N$), defining data of corresponding case.

Output

Output file should be contains T lines. The each of lines should be consists two integer number: maximal and minimal numbers of moves of a checker piece for corresponding test case.

Example

E.in	E.out
2 3 2 6 2	2 2 5 3

Problem F. Product of coprimes (1st Division Only!)

Input file: `F.in`
Output file: `F.out`
Time limit: 2 seconds
Memory limit: 256 megabytes

You are given a natural number m. You are required to calculate the product of all natural numbers not exceeded m and coprimes with m, and yield this product modulo m.

Input

The only line of input file contains given natural number $m \le 10^{18}$.

Output

In the output file you should write the answer of the task.

Examples

F.in	F.out
1	0
2	1
3	2
4	3
5	4
6	5
7	6

Problem G. Divisibility of binomial coefficients (1st Division Only!)

Input file:	`G.in`
Output file:	`G.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

Let us denote $C_n^i = \frac{n!}{i!(n-i)!}$, where $0 \le i \le n$ and n, i are integer numbers. You are given a natural number n and a prime number p. We denote by k the greatest nonnegative integer such that inequality $p^k \le n$ holds. Then we denote by a_j ($j \ge 0$) the number of integers i from $\{0, 1, \ldots, n\}$ such that C_n^i is divisible by p^j, but is not divisible by p^{j+1}. It is easy to verify that $a_j = 0$ for $j > k$. Therefore you are required to find numbers $a_0, a_1, \ldots, a_k$.

Input

The only line of the input file consists of a natural number $n \le 10^{18}$ and a prime number $p < 10^{18}$.

Output

On the only line of the output file write numbers $a_0, a_1, \ldots, a_k$ separated by spaces.

Examples

G.in	G.out
4 2	2 1 2
8 3	9 0
4 5	5

Problem H. Factorial and fourth degree (1st Division Only!)

Input file:	`H.in`
Output file:	`H.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

For a natural number m and a prime number p let us denote by $\deg_p(m)$ the multiplicity of p in the canonical prime decomposition of m. You are given a natural number n and a prime number p. It is required to calculate a remainder of the division of $n!/p^{\deg_p(n!)}$ by p^4. In other words, we divide $n!$ by p while it is possible, and yield obtained number modulo p^4. A number n is given in a base-p notation, i.e. $n = d_{L-1}p^{L-1} + d_{L-2}p^{L-2} + \ldots + d_1 p + d_0$, where $d_{L-1}, d_{L-2},\ ldots, d_1, d_0$ are some nonnegative integers less than p (digits of a number n in a base-p notation).

Input

The first line of the input file consists of a prime number p ($3 < p < 55000$) and a natural number $L \leq 500000$, where L is length of a base-p notation of a number n. The second line consists of numbers $d_{L-1}, d_{L-2}, \ldots, d_1, d_0$, where $d_{L-1} > 0$.

Output

In the output file you should write the answer of the task.

Examples

H.in	H.out
5 5 1 2 1 3 4	607
11 10 2 0 3 6 9 0 6 2 6 10	8891

Problem I. Sum of two squares (1st Division Only!)

Input file:	`I.in`
Output file:	`I.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

It is well known that any prime number p of the form $4k+1$ can be presented as the sum of squares of two natural numbers. Moreover, this presentation is unique. In this task you are proposed to find required presentation. To simplify the task prime numbers of the form $8k+5$ will be only considered.

Input

The first line contains a natural number $T \leq 1000$, the number of primes of the form $8k+5$, which will be considered. In following T lines these numbers are given. It is provided that each of them is prime, has remainder 5 when divided by 8, and does not exceed 10^{18}.

Output

For each prime p from input file you should output in a separate line the pair of numbers x and y such that $x < y$ and $x^2 + y^2 = p$.

Examples

I.in	I.out
4 5 13 29 999999999999999989	1 2 2 3 2 5 260483990 965478167

Problem J. Shehrzad's stories

Input file:	`J.in`
Output file:	`J.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

...Here Shehrzad perceived the day and was silent...
«One Thousand and One Nights»

And when King Shehriyar knew about his wife's unfaithfulness, then went up to his palace, and drew his sword and decapitated his wife, and black slaves, and concubines. Then he took an oath that every night he would marry chaste girl and in the morning put her to death. And so it happened and had been continuing during three years, till the land was stripped of marriageable girls, and all the women and mothers and fathers wept and cried out against the King, cursing him and complaining to the Creator of heaven and earth and calling for succour upon Him who heard prayer and answered those that cry to Him; and those that had daughters left fled with them, till at last there remained not a single girl in the city apt for marriage.

One day the King ordered the Vizier to bring him a maid as of wont; so the Vizier went out and made search for a girl, but found not one and returned home troubled and careful for fear of the king's anger. Now this Vizier had two daughters, the elder called Shehrzad and the younger Dunyazad, and the former had read many books and histories and chronicles of ancient kings and stories of people of old time.

When the Vizier heard his daughter's words, he told her his case, and she said, "By Allah, O my father, marry me to this king, for either I will be the means of the deliverance of the daughters of the Muslims from slaughter or I will die and perish as others have perished." And the Vizier was not able to dissuade Shehrzad. Then he went up to King Shehriyar and kissing the earth before him, told him about his daughter and how she would have him give her to him that next night.

But Shehrzad said to her sister Dunyazad, "O my sister, note well what I shall enjoin thee. When I go up to the Sultan, I will send after thee, and when thou come to me, ask me to tell some stories".

And so it happened, and the King being wakeful, was pleased to hear a story and allowed Shehrzad to start her story. But when the morning came, Shehrzad had been silent at most interest moment. And Shehriyar said to himself, "What a charming and delightful story! By Allah, I will not kill her, till I hear the rest of the story!".

So it had been continued during many nights: Shehrzad continued undertold story of previous night from that moment, where she stopped in morning, and as soon as this story was finished, she immediately started other one, fascinating the King at new subject.

But Shehrzad had to follow that stories was not repeated, and (perhaps, except the last) was not finished in the morning. Then the King either kill Shehrzad, or fall in love with her by that time so that the hand does not arise. Naturally, the more stories she tells, the more Shehriyar's love, and the more chance of staying alive.

Input

In the first line of the input line it is given integer number N ($1 \le N \le 10000$), which define the number of stories known by Shehrzad. The second line consists of N natural number not exceeded 100, which define stories durations in hours. It is considered that each night lasts 8 hours.

Output

On the first line output maximal number of stories, which can told by Shehrzad, and on the second line write durations of these stories in order, that she must tell her stories.

Examples

J.in	J.out
6 1 2 3 4 5 6	6 1 2 3 4 5 6
2 8 9	2 9 8
4 4 4 8 12	3 4 8 12

Problem K. Pairwise different distances

Input file:	`K.in`
Output file:	`K.out`
Time limit:	4 seconds
Memory limit:	256 megabytes

For a given natural number N it is required to construct the set of N points of the Cartesian plane with integer coordinates such that all pairwise distances between points would be different.

Input

The only line of the input file contains a natural number $N \leq 200$, defining the number of points in a set.

Output

In the output file you should write coordinates of points of a constructed set (each points should be in single line, its coordinates should be separated by space). Coordinates of points can not exceed 800 by absolute value. It is provided that there exists such set. If there are many sets satisfying conditions, you can output any of them.

Examples

K.in	K.out
1	800 -800
2	0 0 0 1
4	0 0 0 1 0 3 0 7

Problem L. Two snails (2nd Division Only!)

Input file:	`L.in`
Output file:	`L.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

There is a rectangular field consisting of M rows and N columns. The snail has traversed this field by spiral clockwise starting from upper left corner. At that all cells has been consecutively numbered in order of traversal by numbers 1, 2, 3,. . ..

Now the other snail is appearing on this field in a cell (i_1, j_1). It is necessary for him to reach a cell (i_2, j_2). Each second the snail can move into adjacent cell by horizontal or by vertical on condition that the number of this cell differs from the number of previous cell on at most k.

Your task is to determine how long the travel of second snail takes.

Input

The input file contains integer numbers M, N, k, i_1, j_1, i_2, j_2 ($1 \le M, N \le 1000$, $1 \le k \le 20000$, $1 \le i_1, i_2 \le M$, $1 \le j_1, j_2 \le N$).

Output

In the output file write one integer number: the minimal time needed for second snail to reach required cell.

Examples

L.in	L.out
3 5 1 1 2 3 4	6
5 5 7 3 1 3 3	4

Problem M. Triangular room (2nd Division Only!)

Input file: `M.in`
Output file: `M.out`
Time limit: 2 seconds
Memory limit: 256 megabytes

Many books on entertaining mathematics contain following task. *Arrange 3 chairs around the perimeter of triangular room such that there would be 2 chairs near each wall. The solution of this problem is to put one chair in each corner of the room.*

Consider more general problem. Let the room is represented by triangle ABC. The total number of chairs n, the number of chairs n_{AB}, which must be standing near wall AB, the number of chairs n_{BC}, which must be standing near wall BC, and the number of chairs n_{AC}, which must be standing near wall AC are given. It is necessary to find the number of arrangements satisfying conditions. Chairs can be put in corners of the room or along walls only, and should not be put in the center of the room. In each corner you can put any number of chairs.

Input

The input file contains integer numbers n, n_{AB}, n_{BC}, n_{AC} ($0 \le n, n_{AB}, n_{BC}, n_{AC} \le 1000$).

Output

Write the number of different chairs arrangements in first line of the input file. If there is at least one arrangement, write 6 nonnegative integer numbers in the second line: k_A, k_{AB}, k_B, k_{BC}, k_C, k_{AC}, represented number of chairs, which must be put in the corner A, along the wall AB, in the corner B, along the wall BC, in the corner C and along the wall AC respectively.

Examples

M.in	M.out
3 2 2 2	1 1 0 1 0 1 0
3 3 2 2	0

Problem N. Get equal (2nd Division Only!)

Input file:	`N.in`
Output file:	`N.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

On the table there are cards. On each card it is written some number. Moreover, there is a quite large stack of empty cards. For one turn, it is allowed take away from the table two cards with equal numbers, then take two empty cards from stack, write a number on each of them and put them on the table.

It is required to determine how to make the equal numbers were written on all cards on the table.

Input

The first line contains the number of cards N on the table ($1 \le N \le 30000$). The second line consists of N numbers, written of cards. All numbers is positive integer and does not exceed 10^9.

Output

On the first line output the number of operations L, which necessary to get all equal cards on the table. The value of L is not necessary to be optimal, but does not exceed N. On each of following L lines output four numbers describing corresponding turn: first and second ones are numbers on taken off cards, third and fourth ones are numbers written on new cards. If it is impossible to get all equal cards, output the only number -1.

Examples

N.in	N.out
3 1 2 2	1 2 2 1 1
6 3 3 3 4 4 4	2 3 3 4 3 3 3 4 4

Problem O. Jumps on strip (2nd Division Only!)

Input file:	`O.in`
Output file:	`O.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

The horizontal strip $1 \times N$ is divided into cells of size 1×1. In the cell with number s there is a checker piece. In the first turn, a piece should move one cell (left or right). Second move should be made through two cells, etc. Each next move should be greater than previous one by 1. So it has been continued while a checker piece has moves not overstepping the bounds of strip.

Your task is to determine maximal and minimal numbers of moves that a piece can move.

Input

The first line of the input file contains the number of test cases T ($1 \le T \le 20$). Each of following T lines consists of two integer numbers N и s ($1 \le N \le 1000$, $1 \le s \le N$), defining data of corresponding case.

Output

Output file should be contains T lines. The each of lines should be consists two integer number: maximal and minimal numbers of moves of a checker piece for corresponding test case.

Example

O.in	O.out
2 3 2 6 2	2 2 5 3

Problem P. Product of coprimes (2nd Division Only!)

Input file: `P.in`
Output file: `P.out`
Time limit: 2 seconds
Memory limit: 256 megabytes

You are given a natural number m. You are required to calculate the product of all natural numbers not exceeded m and coprimes with m, and yield this product modulo m.

Input

The only line of input file contains given natural number $m \leq 10^{12}$.

Output

In the output file you should write the answer of the task.

Examples

P.in	P.out
1	0
2	1
3	2
4	3
5	4
6	5
7	6

Problem Q. Indivisibility of binomial coefficients (2nd Division Only!)

Input file:	`Q.in`
Output file:	`Q.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

Let us denote $C_n^i = \frac{n!}{i!(n-i)!}$, where $0 \leq i \leq n$ and n, i are integer numbers. You are given a natural number n and a prime number p. You are required to find numbers of integers i from $\{0, 1, \ldots, n\}$ such that C_n^i is not divisible by p.

Input

The only line of the input file consists of a natural number $n \leq 10^{18}$ and a prime number $p < 10^{18}$.

Output

In the output file you should write the answer of the task.

Examples

Q.in	Q.out
4 2	2
8 3	9
4 5	5

Problem R. Irrational pairwise distances (2nd Division Only!)

Input file:	`R.in`
Output file:	`R.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

For a given natural number N it is required to construct the set of N points of the Cartesian plane such that

- coordinates of points are integer;
- a distance between any two points of the set is irrational;
- any three points of the set does not lie on one line.

Input

The only line of the input file contains a natural number $N \leq 1000$, defining the number of points in a set.

Output

In the output file you should write coordinates of points of a constructed set (each points should be in single line, its coordinates should be separated by space). Coordinates of points can not exceed 1000000 by absolute value. It is provided that there exists such set. If there are many sets satisfying conditions, you can output any of them.

Examples

R.in	R.out
1	1000000 -1000000
2	0 0 1 1
3	0 0 1 1 -1 2

Problem S. Minimaximal matching (2nd Division Only!)

Input file:	`S.in`
Output file:	`S.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

You are given the complete bipartite graph. Each part of this graph has N vertices, i.e. the graph is balanced. An integer number (called a weight) assigns to each vertex. The weight of the edge is defined as a product of weights of vertices which connected by this edge.

Is is well known, a matching in a graph is a set of edges without common vertices. A matching is perfect, if it covers all vertices of a graph, i.e. each graph vertex is incident to some edge of matching.

Your task is to find a perfect minimaximal matching, i.e. such matching, that maximal weight of matching edges would be minimal. (as less as possible).

Input

The first line of the input file contains integer number N ($1 \le N \le 10^5$). The second line consist of N integer numbers, not exceeded 10^9 by absolute value. The i-th number in line denotes a weight of i-th vertex of first part of a graph. In the third line, weights of vertices of second part are presented. Vertices of each part have numbers from 1 to N.

Output

On the first line of output file output the weight of perfect minimaximal matching, i.e. the maximal weight of its edges. The second line should contains a description of this matching in the form of N integer numbers. i-th number denotes a number of vectex in second part, which connected with i-th vertex in first part by a matching edge.

Example

S.in	S.out
3 1 2 3 9 10 11	27 2 3 1

Problem T. Number of quadratic residues (2nd Division Only!)

Input file:	`T.in`
Output file:	`T.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

Let m is certain natural number. A number $a \in \{0, 1, \ldots, m-1\}$ is called a quadratic residue modulo m if there exists an integer x such that $x^2 - a$ is divisible by m. You are given m and required to find the number of quadratic residues modulo m.

Input

In the first line of input file you are given the number of test cases $T \leq 100$. Each of following T lines contains a number m for respective case. It is provided that all numbers does not exceed 10^{12}.

Output

For each case you should output in a separate line the number of quadratic residues modulo m.

Examples

T.in	T.out
5 1 2 3 4 12	1 2 2 2 4