2017 Wuhan University Programming Contest

ACM/ICPC Team of Wuhan University

Sun, Apr 16, 2017

Problem A. AC Automaton

Input file:	`standard input`
Output file:	`standard output`
Time limit:	5 seconds
Memory limit:	1 gigabytes

As an ACMer, GSS is addicted to AC Automaton, i.e. how to AC automatically. GSS believes that he will implement it in the future, so he works hard on it. However, it's almost impossible for machines to understand the problem descriptions with the stateofart natural language processing technology.

As we all know, nothing can stop GSS. To achieve this great goal and rescue every ACMer, GSS spares no effort to solve it. One day, an idea occurs to him. What about the entropy? According to Ludwig Eduard Boltzmann, the entropy can be understood in terms of molecular disorder' within a system. Thus, GSS decides to do some research on the entropy of the input files of some ACM problems. He believes that he can find the law from the input files, then connect it to the output. After the day he finishes it, every ACMer will be retired.

To find the law from the input files, GSS has already done lots of experiments on these input files. The modular arithmetic can reach the best performance, so he defines that the entropy of connecting two numbers a, b is $\min(a \mod b, b \mod a)$.

Generally, the output will be related to every number in the input file. It's quite easy for GSS to solve. Why not connect every number with the minimum total entropy? Perfect solution. Please tell GSS what is the minimum total entropy of connecting all the numbers of an input file.

Input

The input file consists of six numbers n, x_1, a, b, c, m, describing an input files you should calculate the minimum total entropy of it.

$n(2 \le n \le 10^7)$, is the numbers of number in the input file.

$x_1(0 \le x_1 < m)$, is the first number of the input file.

And the rest numbers of the input file can be generated by the following formula:

$x_{i+1} = (ax_i^2 + bx_i + c) \mod m$

$a, b, c(0 \le a, b, c < m)$, $m(2 \le m \le 3 \times 10^6)$, are the parameters of the formula.

(From the above formula, you will find that ACM problem authors are so lazy that they always generate the datasets randomly.)

Output

Output a number representing the minimum entropy of the given input file.

Examples

standard input	standard output
3 2 0 1 1 10	1

Note

The numbers of the input file: 2 3 4

$x_1 = 2$

$x_2 = (0 \times 2^2 + 1 \times 2 + 1) \mod 10 = 3$

$x_3 = (0 \times 3^2 + 1 \times 3 + 1) \mod 10 = 4$

The entropy of connecting two numbers:

$(2, 3) = 1, (2, 4) = 0, (3, 4) = 1$

So we connect $(2, 3)$ and $(2, 4)$, the total entropy is $0 + 1 = 1$.

Problem B. Kids' Riddle

Input file:	`standard input`
Output file:	`standard output`
Time limit:	0.3 seconds
Memory limit:	1 gigabytes

Friends, have you ever taken the April Fools Contest 2017 at Codeforces? There is a problem called Kids' Riddle. The problem description is given below:

Programmers' kids solve this riddle in 5 to 10 minutes. How fast can you do it?

After long time thinking, the authors of our problem found out the rule. Just count the number of holes in hexadecimal notation. And now, it becomes the problem to you. Please solve the Kids' Riddle problem.

Input

The input contains a single integer $n(0 \leq n \leq 2000000000)$.

Output

Output a single integer.

Examples

standard input	standard output
61441	2

Note

The hexadecimal notation of 61441 is `F001`, there are two holes in it.

Problem C. Kanna the insect catcher

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

Kanna is interested in catching insects. She was used to catching insects with her sweep net. But resently, she found it was more effective to set traps. She plans to set N circular traps, k th trap is at (X_k, Y_k) and its radius is R_k. It can capture W_k insects. When two traps are intersectant (excluding tangent) they will become useless. So Kanna wants to choose some traps to set so that she can catch maximum insects. Can you help her?

Input

One integer $N(1 \leq N \leq 2000)$ in the first line.

In the following N lines, k-th line has 4 integers $X_k, Y_k, R_k, W_k(1 \leq X_k, Y_k, R_k \leq 10^8, 1 \leq Wk \leq 10^6)$.

All these input have been explained above.

Because the area she set traps is so narrow, each horizontal line will cross (excluding tangent) at most two traps from the N traps.

Output

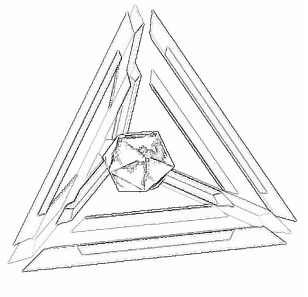
One integer in one line, represents the maximum insects Kanna can catch.

Examples

standard input	standard output
6 1 1 1 1 3 1 1 2 1 4 2 3 4 8 3 4 4 3 1 5 2 10 3 3	15

Problem D. Link Established

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



Link Amp.

GSS is an AFK player of the game Ingress.

There is an operation called link in ingress. Which means that you can link two portals (points on earth) by a link. A link is the shortest line (measured along the surface of the sphere) between two points on the surface of a sphere. on surface of Earth. And the new link cannot intersect any of exist links.

Now you want to link two portals but there exists another link, your task is to answer if the link can be established or not. If the link cannot be established, you should answer where will the two links intersect.

Input

Input contains multiple cases, please process to end of file.

The only line of each test case contains eight float numbers Lat_A, Lon_A, Lat_B, Lon_B, Lat_C, Lon_C, Lat_D, Lon_D.

($-180 \leq Lon_A, Lon_B, Lon_C, Lon_D < 180$, $-90 \leq Lat_A, Lat_B, Lat_C, Lat_D \leq 90$). Which means the longitude and latitude of four points A, B, C, D. The exist link is AB, and you want to establish a link between C and D.

The input promises that whether the answer exists won't change if the longitude and latitude is changed less than 10^{-6}.

Output

For each test case, you should output one line.

If you can establish the link, just output a single word `"YES"`.

If you cannot establish the link, you should output `"NO"`and then two numbers Lon_X and Lat_X which means the longitude and latitude of the point where the two links will intersect.

Your answer will be considered as correct if the relative or absolute error is less than 10^{-6}

Examples

standard input	standard output
30.544828 114.414566 30.572582 114.37041 30.535808 114.354571 30.51306 114.401143 -72.113 -53.663 -27.586 93.787 -27.304 148.797 -55.532 -19.497	YES NO 14.48718221 -81.33265715

Note

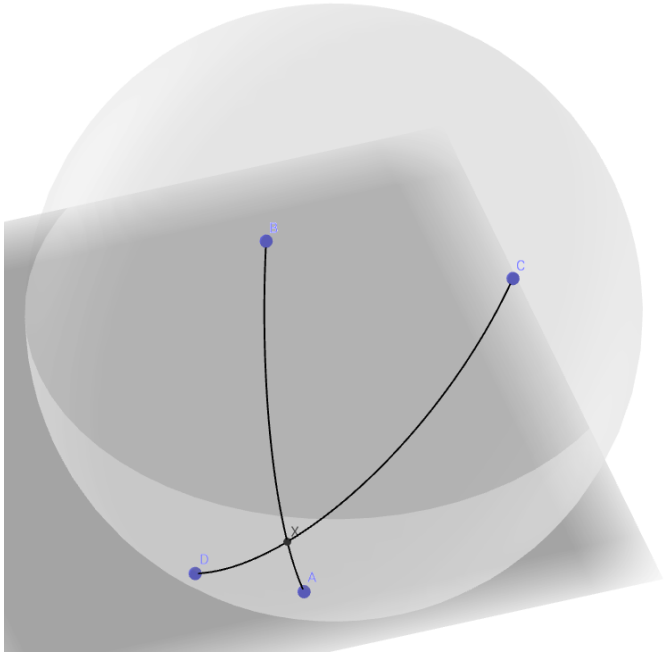
The first case is:

30.544828 114.414566 30.572582 114.37041 30.535808 114.354571 30.51306 114.401143.

And the second case is:

-72.113 -53.663 -27.586 93.787 -27.304 148.797 -55.532 -19.497.

The second case looks like the following picture.



Problem E. Your NP has been charged full

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

The strongest master in the world, Gudako, is always busy battling in specific points. Today, as usual, she summoned her most favorite servant Alash to fight against her enemies.

With the help of Kong Ming and Merlin, Alash can use his famous noble phantasm Stella immediatly, and before that Irisviel will make sure the big hero will not die for the deadly attack. That's a good circulation, because it means Alash can make powerful enough attack every turn.

Now the question comes to Gudako. There are three kinds of buffs for attack, magic and noble phantasm(assume they are called "a","b","c"), and in each turn she can choose one kind of buff to put on Alash, then the buff will exist for three turns(if it's the k-th turn now, it will exist until the end of $k+2$-th turn).

The buff is calculated by the following fomular:

$$(1+\sum a_i)(1+\sum b_i)(1+\sum c_i)$$

Where $\sum a_i$ is the sum of selected buff of type "a", and $\sum b_i$ is the sum of selected buff of type "b", and $\sum c_i$ is the sum of selected buff of type "c".

Gudako wants to know how to get the most powerful attack, but she doesn't want to think about the choices herself. Alash is so tired, for Merlin and Kong Ming think the question is too easy, and Irisviel is so beautiful that everyone just want to protect her, so the problem comes to you, the Grand ACMer. Try to tell Gudako the answer. The original attack is 1.

Input

The first line contains a single integer $n(2 \le n \le 10000)$.

In the next n lines, each line consists of three floats $a_i, b_i, c_i (0 \le a_i, b_i, c_i \le 1)$, that's the differnt buffs for the i-th turn.

Output

Output one line containing the answer, your answer will be correct if absolute or relative error is less than or equal to 10^{-6}.

Examples

standard input	standard output
3 0.1 0.1 0 0.2 0.2 0.2 0.1 0.2 0.3	4.13600000

Problem F. The Highest Peak

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

Long long ago, Wuhan University locates a plain with the same height. There are N points in WHU which are connected by $N-1$ edges (just like a tree) and their initial height is 0 meters. Now we want to heap up sail on the points to form peaks and you should answer the number and the height of the highest peak.

Input

First line is N and K, the number of the points and the number of actions to head up. $(0 < N, K \leq 5 \times 10^5)$

Next $N-1$ lines includes two numbers X and Y, meaning that the point X and point Y are connected directly. $(0 < X, Y \leq N)$

In the following K lines, each line consists of three integers X, Y, H, means that we will heap up H meters high soil in every points belonging to the path from X to $Y (X \neq Y, 0 < X, Y \leq N, 0 \leq H \leq 10^9)$.

Output

The number and the height of the highest peak (if there are servel highest peaks, select the one who has the smallest number).

Examples

standard input	standard output
5 4 1 2 1 3 2 4 3 5 1 2 5 3 5 6 4 5 9 1 5 1	3 16

Problem G. Room

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1.5 seconds
Memory limit:	1 gigabytes

The ACM / ICPC team has a large room, the length and width of which is 10^6.

However, the guys in ACM / ICPC teams are too lazy to make their study room tidy. So there are wires everywhere and divide the room into several parts. A team in a part of the room cannot move out of it or they might touch the wires and the network will down. To make every team can compete in the contest, they have to set up some facilities such as toilet since the teams should do anything in their parts.

Now, we will give you the map of our study room and the position of the teams, your task is to calculate how many facilities is required to let every team can access a facilities to finish the contest without move out of their part.

You should note that two or more teams can share a facility.

Input

The first line of input is an integer n ($0 \le n \le 100000$), means how many wires in the room.

The next n lines, each line contains four integers (x_a, y_a), (x_b, y_b), the coordinate of two ends of the wire, you should note that both of ends are pinned to walls so that at least one of x_a and y_a is 0 or 10^6, and at least one of x_b, y_b equals to 0 or 10^6.

The next line is an integer t ($0 \le t \le 100$), means how many teams in the room.

The next t lines, each line contains two integers (x_i, y_i), the coordinate of team i.

No teams will sit on the wires since it is too dangerous.

Output

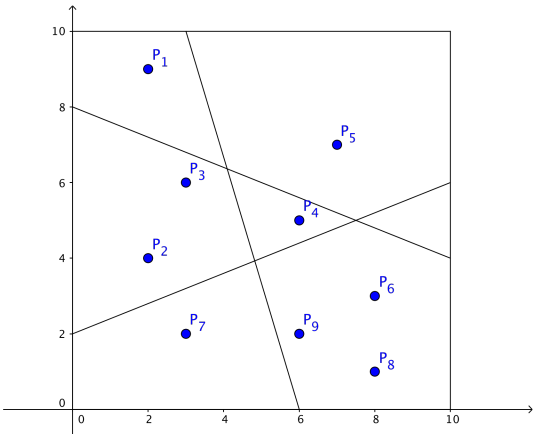
Output one integer, the minimal facilities required.

Examples

standard input	standard output
3 0 200000 1000000 600000 600000 0 300000 1000000 0 800000 1000000 400000 9 200000 900000 200000 400000 300000 600000 600000 500000 700000 700000 800000 300000 300000 200000 800000 100000 600000 200000	6

Note

The sample data looks like the following picture.



Problem H. Rock Paper Scissors

Time limit: 1 second
Memory limit: 1 gigabytes

This is an interactive problem.

If you know the rule of the game Rock-Paper-Scissors, then you can skip the next paragraph.

RockPaperScissors or Scissor-Paper-Rock, is a zero-sum hand game usually played between two people, in which each player simultaneously forms one of three shapes with an outstretched hand. These shapes are "rock"(a simple fist), "paper"(a flat hand), and "scissors"(a fist with the index and middle fingers together forming a V). The game has only two possible outcomes other than a tie: a player who decides to play rock will beat another player who has chosen scissors ("rock crushes scissors") but will lose to one who has played paper ("paper covers rock"); a play of paper will lose to a play of scissors ("scissors cut paper"). If both players choose the same shape, the game is tied and is usually immediately replayed to break the tie. Other names for the game in the English-speaking world include roshambo and other orderings of the three items, sometimes with "rock"being called "stone".

GSS, who loves playing *RPS*, is going to attend a contest of *RPS*, however, his opponent is a computer. Just at the day before the contest, GSS found a bug of the contest server and get the code of computer.

However, the code is written in LISP. So he translated the code into pseudo code.

```
def rps(int your_shape)
  global last_random
  if this is the first call of this function:
    last_random <- a true random number
  computer_shape <- ( 65973 * last_random + 28411 ) % 524288
  last_random <- computer_shape
  computer_shape <- computer_shape % 3
  result <- (your_shape - computer_shape + 3) % 3
  if result is 2: return -1
  elif result is 1: return 1
  elif result is 0: return 0
```

After the translation, GSS is tired and ask you to help him. He said that your goal is to win 1000 rounds **continously** in no more than 2000 rounds.

More exactly, your task is to let the function continously return 1 for 1000 times in no more than 2000 calls.

And for different languages, you have to do the following things:

Common notes For all languages you can use, we will provide a head file / class / package which comtians a function.

The function will return one of $\{0, 1, -1, 100\}$

If the function returns 0, then there is a tie, if the function returns -1, then you lose, if the function returns 1, then you win.

If the function returns 100, you should end your program.

Do not read anything from `stdin` or output anything to `stdout`, or the behavior is undefined.

C / C++ If you are using C or C++, you have to include `rps.h`.

That head provides a function `int cc17_rps(int your_shape)`.

Then, you can call `cc17_rps(your_shape)` to play the game with computer.

For example, if your shape is *Paper* then you should call `cc17_rps(0)`, *Scissors* call `cc17_rps(1)` and *Rock* call `cc17_rps(2)`.

Java If you are using Java, we will provide a class named `CC17`.

Firstly, you have to write `CC17 rps = new CC17(System.in, System.out);`. Then you will get an object called *rps*. Please note that you can only do this once or the behavior is undefined.

That class provides a function `public int rps(int yourShape)`.

Then, you can call `rps.rps(yourShape)` to play the game with computer.

For example, if your shape is *Paper* then you should call `rps.rps(0)`, *Scissors* call `rps.rps(1)` and *Rock* call `rps.rps(2)`.

Python2 / 3 If you are using Python, we will provide a package named `CC17`, you should import `CC17` in your source code.

That package provides a function `rps(your_shape)`.

Then, you can call `CC17.rps(your_shape)` to play the game with computer.

For example, if your shape is *Paper* then you should call `CC17.rps(0)`, *Scissors* call `CC17.rps(1)` and *Rock* call `CC17.rps(2)`.

Examples

Please refer to the problem description on the online judge system. The sample code is provided there.

Problem I. A simple math problem

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

Given a number n, you should calculate $123456 \ldots 11121314 \ldots n$ module 11

Input

A single line with an integer n $(0 < n \leq 10^{18})$

Output

Output one integer, $123456 \ldots 11121314 \ldots n$ module 11

Examples

standard input	standard output
1	1
20	5
21	4

Note

$1 \equiv 1(\mod 11)$

$12345678910111213141516171819 20 \equiv 5(\mod 11)$

$123456789101112131415161718192021 \equiv 4(\mod 11)$.

Problem J. Training

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

GSS has a huge problem set for training. The problem set consists of n types of problems, for example dynamic programming, graph theory, data structures and so on. For the i-th type of problem, GSS has k_i problems. And each day, GSS will pick one problem from his problem set in random and solve that. After that, he will remove that problem from the problem set and never pick it again.

GSS found that if he has solve at least one problem from each type, he will become very moe. (But he doesn't know why he will become moe.) And he wants to know the expected time to solve at least one problem from each of the n types.

Input

The first line of input is an integer n. $(0 < n \leq 50)$

The second line contains n positive integers, $k_1, k_2, \ldots k_n$ $(n \leq \sum k_i \leq 1000)$

Output

Output the expected time to solve at least one problem from each of the n types.

If your answer is p/q, then you should output pw module 998244353.

Where $w = q^{998244351}$.

Examples

standard input	standard output
5 1 1 1 1 1	5
2 2 2	332748120

Note

In the second sample, the mean time for GSS to solve each type of problem at least one time is $2 \times 2/3 + 3 \times 1/3 = 14/6$.

$998244353 = 2^{23} \times 7 \times 17 + 1$ and it is a prime.

Problem K. Wifi Relay

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	1 gigabytes

The ACM/ICPC team has bought n wifi APs. And the APs have a special feature called Wifi Relay which means if two APs' signal can cover each other, then they can work like a single wifi AP.

Each AP can cover a round area, the radius of which is r.

In a programming contest, GSS set up n APs, and the i-th AP is placed at (x_i, y_i). Then GSS use the Wifi Relay to let all the APs work like a single AP that every one can access the system without being interrupted.

Then GSS has to set all the radius each APs can cover to r. To save pover, GSS has to get the minimal r he should set, can you help him to do that?

Input

The first line of input is an integer n. $(2 \leq n \leq 10^4)$

The following n lines, the i-th one of them contains two integers (x_i, y_i), the position GSS place i-th AP. $(0 \leq x_i, y_i \leq 10^8)$

Output

Output one integer, the minimal r GSS should set. Your answer will be considered as correct if the relative or absolute error is less than 10^{-9}

Examples

standard input	standard output
3 0 0 10 10 10 0	5.0000000000

Problem L. Young and too simple

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	1 gigabytes

You are given a sequence $a_1, a_2, \ldots, a_n$ consisting of positive integer.

You have to answer q queries:

A query is defined by a triplet of numbers (l_i, r_i, x_i). For each query, you have to find the largest a_p such that $l_i \leq p \leq r_i$ and a_p is coprime with x_i or determine that there is no such a_p.

Input

The first line of the input contains two integers n and p $(1 \leq n, q \leq 10^5)$.

The second line contains n integers $a_1, a_2, \ldots a_n (1 \leq a_i \leq 10^5$, you can think that a_i is generated in random).

The next m lines contains queries. The i-th of these lines contains three integers

l_i, r_i, and x_i. $(1 \leq l_i \leq r_i \leq n$, $1 \leq x_i \leq 10^5)$.

Output

For each query, output the largest a_p in a separate line. If there are no such a_p output `-1`.

Examples

standard input	standard output
5 4 8 5 1 10 2 1 5 10 2 3 7 1 3 4 2 2 5	1 5 5 -1