Codeforces Round #412 (rated, Div. 2, base on VK Cup 2017 Round 3)

A. Is it rated?

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Is it rated?

Here it is. The Ultimate Question of Competitive Programming, Codeforces, and Everything. And you are here to answer it.

Another Codeforces round has been conducted. No two participants have the same number of points. For each participant, from the top to the bottom of the standings, their rating before and after the round is known.

It's known that if at least one participant's rating has changed, then the round was rated for sure.

It's also known that if the round was rated and a participant with lower rating took a better place in the standings than a participant with higher rating, then at least one round participant's rating has changed.

In this problem, you should not make any other assumptions about the rating system.

Determine if the current round is rated, unrated, or it's impossible to determine whether it is rated of not.

Input

The first line contains a single integer n $(2 \leq n \leq 1000)$ — the number of round participants.

Each of the next n lines contains two integers a_i and b_i $(1 \leq a_i, b_i \leq 4126)$ — the rating of the i-th participant before and after the round, respectively. The participants are listed in order from the top to the bottom of the standings.

Output

If the round is rated for sure, print "`rated`". If the round is unrated for sure, print "`unrated`". If it's impossible to determine whether the round is rated or not, print "`maybe`".

Examples

input

```
6
3060 3060
2194 2194
2876 2903
2624 2624
3007 2991
2884 2884
```

output

```
rated
```

input

```
4
1500 1500
1300 1300
1200 1200
1400 1400
```

output

```
unrated
```

input

```
5
3123 3123
2777 2777
2246 2246
2246 2246
1699 1699
```

output

```
maybe
```

Note

In the first example, the ratings of the participants in the third and fifth places have changed, therefore, the round was rated.

In the second example, no one's rating has changed, but the participant in the second place has lower rating than the participant in the fourth place. Therefore, if the round was rated, someone's rating would've changed for sure.

In the third example, no one's rating has changed, and the participants took places in non-increasing order of their rating. Therefore, it's impossible to determine whether the round is rated or not.

B. T-Shirt Hunt

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Not so long ago the Codecraft-17 contest was held on Codeforces. The top 25 participants, and additionally random 25 participants out of those who got into top 500, will receive a Codeforces T-shirt.

Unfortunately, you didn't manage to get into top 25, but you got into top 500, taking place p.

Now the elimination round of 8VC Venture Cup 2017 is being held. It has been announced that the Codecraft-17 T-shirt winners will be chosen as follows. Let s be the number of points of the winner of the elimination round of 8VC Venture Cup 2017. Then the following pseudocode will be executed:

```
i := (s div 50) mod 475
repeat 25 times:
    i := (i * 96 + 42) mod 475
    print (26 + i)
```

Here "`div`" is the integer division operator, "`mod`" is the modulo (the remainder of division) operator.

As the result of pseudocode execution, 25 integers between 26 and 500, inclusive, will be printed. These will be the numbers of places of the participants who get the Codecraft-17 T-shirts. It is guaranteed that the 25 printed integers will be pairwise distinct for any value of s.

You're in the lead of the elimination round of 8VC Venture Cup 2017, having x points. You believe that having at least y points in the current round will be enough for victory.

To change your final score, you can make any number of successful and unsuccessful hacks. A successful hack brings you 100 points, an unsuccessful one takes 50 points from you. It's difficult to do successful hacks, though.

You want to win the current round and, at the same time, ensure getting a Codecraft-17 T-shirt. What is the smallest number of **successful** hacks you have to do to achieve that?

Input

The only line contains three integers p, x and y ($26 \le p \le 500$; $1 \le y \le x \le 20000$) — your place in Codecraft-17, your current score in the elimination round of 8VC Venture Cup 2017, and the smallest number of points you consider sufficient for winning the current round.

Output

Output a single integer — the smallest number of successful hacks you have to do in order to both win the elimination round of 8VC Venture Cup 2017 and ensure getting a Codecraft-17 T-shirt.

It's guaranteed that your goal is achievable for any valid input data.

Examples

input

```
239 10880 9889
```

output

```
0
```

input

```
26 7258 6123
```

output

```
2
```

input

```
493 8000 8000
```

output

```
24
```

input

```
101 6800 6500
```

output

```
0
```

input

```
329 19913 19900
```

output

```
8
```

Note

In the first example, there is no need to do any hacks since 10880 points already bring the T-shirt to the 239-th place of Codecraft-17 (that is, you). In this case, according to the pseudocode, the T-shirts will be given to the participants at the following places:

```
475 422 84 411 453 210 157 294 146 188 420 367 29 356 398 155 102 239 91 133 365 312 449 301 343
```

In the second example, you have to do two successful and one unsuccessful hack to make your score equal to 7408.

In the third example, you need to do as many as 24 successful hacks to make your score equal to 10400.

In the fourth example, it's sufficient to do 6 unsuccessful hacks (and no successful ones) to make your score equal to 6500, which is just enough for winning the current round and also getting the T-shirt.

C. Success Rate

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

You are an experienced Codeforces user. Today you found out that during your activity on Codeforces you have made y submissions, out of which x have been successful. Thus, your current success rate on Codeforces is equal to x / y.

Your favorite rational number in the $[0;1]$ range is p / q. Now you wonder: what is the smallest number of submissions you have to make if you want your success rate to be p / q?

Input

The first line contains a single integer t $(1 \le t \le 1000)$ — the number of test cases.

Each of the next t lines contains four integers x, y, p and q $(0 \le x \le y \le 10^9;\ 0 \le p \le q \le 10^9;\ y > 0;\ q > 0)$.

It is guaranteed that p / q is an irreducible fraction.

Hacks. For hacks, an additional constraint of $t \le 5$ must be met.

Output

For each test case, output a single integer equal to the smallest number of submissions you have to make if you want your success rate to be equal to your favorite rational number, or `-1` if this is impossible to achieve.

Example

input

```
4
3 10 1 2
7 14 3 8
20 70 2 7
5 6 1 1
```

output

```
4
10
0
-1
```

Note

In the first example, you have to make 4 successful submissions. Your success rate will be equal to $7 / 14$, or $1 / 2$.

In the second example, you have to make 2 successful and 8 unsuccessful submissions. Your success rate will be equal to $9 / 24$, or $3 / 8$.

In the third example, there is no need to make any new submissions. Your success rate is already equal to $20 / 70$, or $2 / 7$.

In the fourth example, the only unsuccessful submission breaks your hopes of having the success rate equal to 1.

D. Dynamic Problem Scoring

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Vasya and Petya take part in a Codeforces round. The round lasts for two hours and contains five problems.

For this round the dynamic problem scoring is used. If you were lucky not to participate in any Codeforces round with dynamic problem scoring, here is what it means. The maximum point value of the problem depends on the ratio of the number of participants who solved the problem to the total number of round participants. Everyone who made at least one submission is considered to be participating in the round.

Solvers fraction	Maximum point value
$(1/2, 1]$	500
$(1/4, 1/2]$	1000
$(1/8, 1/4]$	1500
$(1/16, 1/8]$	2000
$(1/32, 1/16]$	2500
$[0, 1/32]$	3000

Pay attention to the range bounds. For example, if 40 people are taking part in the round, and 10 of them solve a particular problem, then the solvers fraction is equal to $1 / 4$, and the problem's maximum point value is equal to 1500.

If the problem's maximum point value is equal to x, then for each whole minute passed from the beginning of the contest to the moment of the participant's correct submission, the participant loses $x / 250$ points. For example, if the problem's maximum point value is 2000, and the participant submits a correct solution to it 40 minutes into the round, this participant will be awarded with $2000 \cdot (1 - 40 / 250) = 1680$ points for this problem.

There are n participants in the round, including Vasya and Petya. For each participant and each problem, the number of minutes which passed between the beginning of the contest and the submission of this participant to this problem is known. It's also possible that this participant made no submissions to this problem.

With two seconds until the end of the round, all participants' submissions have passed pretests, and not a single hack attempt has been made. Vasya believes that no more submissions or hack attempts will be made in the remaining two seconds, and every submission will pass the system testing.

Unfortunately, Vasya is a cheater. He has registered $10^9 + 7$ new accounts for the round. Now Vasya can submit any of his solutions from these new accounts in order to change the maximum point values of the problems. Vasya can also submit any wrong solutions to any problems. Note that Vasya can not submit correct solutions to the problems he hasn't solved.

Vasya seeks to score strictly more points than Petya in the current round. Vasya has already prepared the scripts which allow to obfuscate his solutions and submit them into the system from any of the new accounts in just fractions of seconds. However, Vasya doesn't want to make his cheating too obvious, so he wants to achieve his goal while making submissions from the smallest possible number of new accounts.

Find the smallest number of new accounts Vasya needs in order to beat Petya (provided that Vasya's assumptions are correct), or report that Vasya can't achieve his goal.

Input

The first line contains a single integer n $(2 \le n \le 120)$ — the number of round participants, including Vasya and Petya.

Each of the next n lines contains five integers $a_{i,1}, a_{i,2}..., a_{i,5}$ $(-1 \le a_{i,j} \le 119)$ — the number of minutes passed between the beginning of the round and the submission of problem j by participant i, or `-1` if participant i hasn't solved problem j.

It is guaranteed that each participant has made at least one successful submission.

Vasya is listed as participant number 1, Petya is listed as participant number 2, all the other participants are listed in no particular order.

Output

Output a single integer — the number of new accounts Vasya needs to beat Petya, or `-1` if Vasya can't achieve his goal.

Examples

input

```
2
5 15 40 70 115
50 45 40 30 15
```

output

```
2
```

input

```
3
55 80 10 -1 -1
15 -1 79 60 -1
42 -1 13 -1 -1
```

output

```
3
```

input

```
5
119 119 119 119 119
0 0 0 0 -1
20 65 12 73 77
78 112 22 23 11
1 78 60 111 62
```

output

```
27
```

input

```
4
-1 20 40 77 119
30 10 73 50 107
21 29 -1 64 98
117 65 -1 -1 -1
```

output

```
-1
```

Note

In the first example, Vasya's optimal strategy is to submit the solutions to the last three problems from two new accounts. In this case the first two problems will have the maximum point value of 1000, while the last three problems will have the maximum point value of 500. Vasya's score will be equal to $980 + 940 + 420 + 360 + 270 = 2970$ points, while Petya will score just $800 + 820 + 420 + 440 + 470 = 2950$ points.

In the second example, Vasya has to make a single unsuccessful submission to any problem from two new accounts, and a single successful submission to the first problem from the third new account. In this case, the maximum point values of the problems will be equal to 500, 1500, 1000, 1500, 3000. Vasya will score 2370 points, while Petya will score just 2294 points.

In the third example, Vasya can achieve his goal by submitting the solutions to the first four problems from 27 new accounts. The maximum point values of the problems will be equal to 500, 500, 500, 500, 2000. Thanks to the high cost of the fifth problem, Vasya will manage to beat Petya who solved the first four problems very quickly, but couldn't solve the fifth one.

E. Prairie Partition

time limit per test: 2 seconds

memory limit per test: 256 megabytes

input: standard input

output: standard output

It can be shown that any positive integer x can be uniquely represented as $x = 1 + 2 + 4 + \ldots + 2^{k - 1} + r$, where k and r are integers, $k \geq 0$, $0 < r \leq 2^k$. Let's call that representation *prairie partition* of x.

For example, the prairie partitions of 12, 17, 7 and 1 are:

$$12 = 1 + 2 + 4 + 5,$$
$$17 = 1 + 2 + 4 + 8 + 2,$$
$$7 = 1 + 2 + 4,$$
$$1 = 1.$$

Alice took a sequence of positive integers (possibly with repeating elements), replaced every element with the sequence of summands in its prairie partition, arranged the resulting numbers in non-decreasing order and gave them to Borys. Now Borys wonders how many elements Alice's original sequence could contain. Find all possible options!

Input

The first line contains a single integer n ($1 \leq n \leq 10^5$) — the number of numbers given from Alice to Borys.

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \leq a_i \leq 10^{12}$; $a_1 \leq a_2 \leq \ldots \leq a_n$) — the numbers given from Alice to Borys.

Output

Output, **in increasing order**, all possible values of m such that there exists a sequence of positive integers of length m such that if you replace every element with the summands in its prairie partition and arrange the resulting numbers in non-decreasing order, you will get the sequence given in the input.

If there are no such values of m, output a single integer `-1`.

Examples

input

```
8
1 1 2 2 3 4 5 8
```

output

```
2
```

input

```
6
1 1 1 2 2 2
```

output

```
2 3
```

input

```
5
1 2 4 4 4
```

output

```
-1
```

Note

In the first example, Alice could get the input sequence from $[6, 20]$ as the original sequence.

In the second example, Alice's original sequence could be either $[4, 5]$ or $[3, 3, 3]$.

F. Perishable Roads

time limit per test: 3 seconds

memory limit per test: 256 megabytes

input: standard input

output: standard output

In the country of Never, there are n cities and a well-developed road system. There is exactly one bidirectional road between every pair of cities, thus, there are as many as $\frac{n(n-1)}{2}$ roads! No two roads intersect, and no road passes through intermediate cities. The art of building tunnels and bridges has been mastered by Neverians.

An independent committee has evaluated each road of Never with a positive integer called the *perishability* of the road. The lower the road's perishability is, the more pleasant it is to drive through this road.

It's the year of transport in Never. It has been decided to build a museum of transport in one of the cities, and to set a single signpost directing to some city (not necessarily the one with the museum) in each of the other cities. The signposts must satisfy the following important condition: if any Neverian living in a city without the museum starts travelling from that city following the directions of the signposts, then this person will eventually arrive in the city with the museum.

Neverians are incredibly positive-minded. If a Neverian travels by a route consisting of several roads, he considers the *perishability of the route* to be equal to the smallest perishability of all the roads in this route.

The government of Never has not yet decided where to build the museum, so they consider all n possible options. The most important is the sum of perishabilities of the routes to the museum city from all the other cities of Never, if the travelers strictly follow the directions of the signposts. The government of Never cares about their citizens, so they want to set the signposts in a way which minimizes this sum. Help them determine the minimum possible sum for all n possible options of the city where the museum can be built.

Input

The first line contains a single integer n ($2 \leq n \leq 2000$) — the number of cities in Never.

The following n - 1 lines contain the description of the road network. The i-th of these lines contains n - i integers. The j-th integer in the i-th line denotes the perishability of the road between cities i and $i + j$.

All road perishabilities are between 1 and 10^9, inclusive.

Output

For each city in order from 1 to n, output the minimum possible sum of perishabilities of the routes to this city from all the other cities of Never if the signposts are set in a way which minimizes this sum.

Examples

input

```
3
1 2
3
```

output

```
2
2
3
```

input

```
6
2 9 9 6 6
7 1 9 10
9 2 5
4 10
8
```

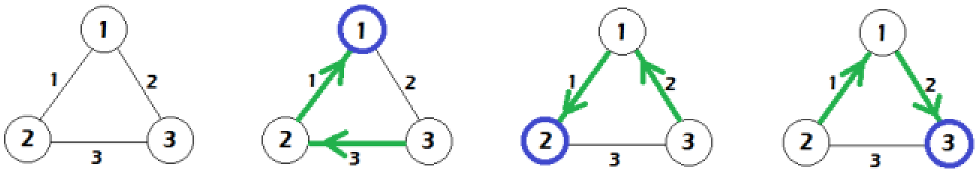
output

```
6
5
7
5
7
11
```

Note

The first example is explained by the picture below. From left to right, there is the initial road network and the optimal directions of the signposts in case the museum is built in city 1, 2 and 3, respectively. The museum city is represented by a blue circle, the directions of the signposts are represented by green arrows.

For instance, if the museum is built in city 3, then the signpost in city 1 must be directed to city 3, while the signpost in city 2 must be directed to city 1. Then the route from city 1 to city 3 will have perishability 2, while the route from city 2 to city 3 will have perishability 1. The sum of perishabilities of these routes is 3.


1
2
3
1
2
3
1
2
3
1
2
3
1
2
3
1
2
3
1
2
3
1
2
3