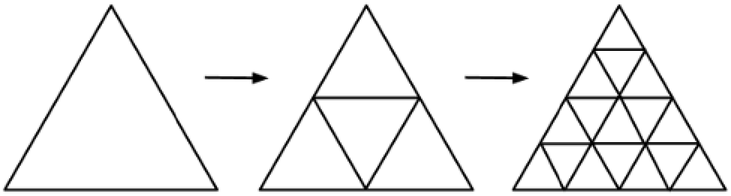
Codeforces Round #118 (Div. 1)

A. Plant

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

Dwarfs have planted a very interesting plant, which is a triangle directed "upwards". This plant has an amusing feature. After one year a triangle plant directed "upwards" divides into four triangle plants: three of them will point "upwards" and one will point "downwards". After another year, each triangle plant divides into four triangle plants: three of them will be directed in the same direction as the parent plant, and one of them will be directed in the opposite direction. Then each year the process repeats. The figure below illustrates this process.



Help the dwarfs find out how many triangle plants that point "upwards" will be in n years.

Input

The first line contains a single integer n $(0 \le n \le 10^{18})$ — the number of full years when the plant grew.

Please do not use the `%lld` specifier to read or write 64-bit integers in C++. It is preferred to use `cin`, `cout` streams or the `%I64d` specifier.

Output

Print a single integer — the remainder of dividing the number of plants that will point "upwards" in n years by 1000000007 $(10^9 + 7)$.

Sample test(s)

input
```
1
```
output
```
3
```

input
```
2
```
output
```
10
```

Note

The first test sample corresponds to the second triangle on the figure in the statement. The second test sample corresponds to the third one.

B. Mushroom Scientists

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

As you very well know, the whole Universe traditionally uses three-dimensional Cartesian system of coordinates. In this system each point corresponds to three real coordinates (x, y, z). In this coordinate system, the distance between the center of the Universe and the point is calculated by the following formula: $\sqrt{x^2 + y^2 + z^2}$. Mushroom scientists that work for the Great Mushroom King think that the Universe isn't exactly right and the distance from the center of the Universe to a point equals $x^a \cdot y^b \cdot z^c$.

To test the metric of mushroom scientists, the usual scientists offered them a task: find such x, y, z $(0 \le x, y, z;\ x + y + z \le S)$, that the distance between the center of the Universe and the point (x, y, z) is maximum possible in the metric of mushroom scientists. The mushroom scientists aren't good at maths, so they commissioned you to do the task.

Note that in this problem, it is considered that $0^0 = 1$.

Input

The first line contains a single integer S $(1 \le S \le 10^3)$ — the maximum sum of coordinates of the sought point.

The second line contains three space-separated integers a, b, c $(0 \le a, b, c \le 10^3)$ — the numbers that describe the metric of mushroom scientists.

Output

Print three real numbers — the coordinates of the point that reaches maximum value in the metrics of mushroom scientists. If there are multiple answers, print any of them that meets the limitations.

A natural logarithm of distance from the center of the Universe to the given point in the metric of mushroom scientists shouldn't differ from the natural logarithm of the maximum distance by more than 10^{-6}. We think that $ln(0) = -\infty$.

Sample test(s)

input

```
3
1 1 1
```

output

```
1.0 1.0 1.0
```

input

```
3
2 0 0
```

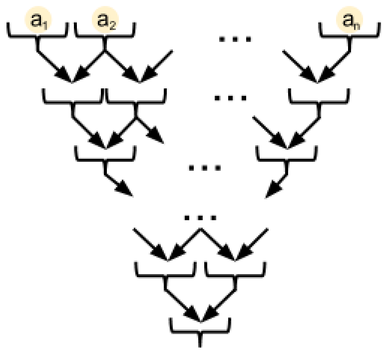
output

```
3.0 0.0 0.0
```

C. Clever Fat Rat

time limit per test: 2.5 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

The Fat Rat and his friend Cerealguy have had a bet whether at least a few oats are going to descend to them by some clever construction. The figure below shows the clever construction.



A more formal description of the clever construction is as follows. The clever construction consists of n rows with scales. The first row has n scales, the second row has $(n - 1)$ scales, the i-th row has $(n - i + 1)$ scales, the last row has exactly one scale. Let's number the scales in each row from the left to the right, starting from 1. Then the value of $w_{i, k}$ in kilograms $(1 \le i \le n; 1 \le k \le n - i + 1)$ is the weight capacity parameter of the k-th scale in the i-th row.

If a body whose mass is not less than $w_{i, k}$ falls on the scale with weight capacity $w_{i, k}$, then the scale breaks. At that anything that the scale has on it, either falls one level down to the left (if possible) or one level down to the right (if possible). In other words, if the scale $w_{i, k}$ $(i < n)$ breaks, then there are at most two possible variants in which the contents of the scale's pan can fall out: **all contents** of scale $w_{i, k}$ falls either on scale $w_{i + 1, k - 1}$ (if it exists), or on scale $w_{i + 1, k}$ (if it exists). If scale $w_{n, 1}$ breaks, then all its contents falls right in the Fat Rat's claws. Please note that the scales that are the first and the last in a row, have only one variant of dropping the contents.

Initially, oats are simultaneously put on all scales of the first level. The i-th scale has a_i kilograms of oats put on it. After that the scales start breaking and the oats start falling down in some way. You can consider everything to happen instantly. That is, the scale breaks instantly and the oats also fall instantly.

The Fat Rat is sure that whatever happens, he will not get the oats from the first level. Cerealguy is sure that there is such a scenario, when the rat gets at least some number of the oats. Help the Fat Rat and the Cerealguy. Determine, which one is right.

Input

The first line contains a single integer n $(1 \le n \le 50)$ — the number of rows with scales.

The next line contains n space-separated integers a_i $(1 \le a_i \le 10^6)$ — the masses of the oats in kilograms.

The next n lines contain descriptions of the scales: the i-th line contains $(n - i + 1)$ space-separated integers $w_{i, k}$ $(1 \le w_{i, k} \le 10^6)$ — the weight capacity parameters for the scales that stand on the i-th row, in kilograms.

Output

Print "`Fat Rat`" if the Fat Rat is right, otherwise print "`Cerealguy`".

Sample test(s)

input

```
1
1
2
```

output

```
Fat Rat
```

input

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

output

```
Cerealguy
```

input

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

output
Fat Rat

Note

Notes to the examples:

- The first example: the scale with weight capacity 2 gets 1. That means that the lower scale don't break.
- The second sample: all scales in the top row obviously break. Then the oats fall on the lower row. Their total mass is 4,and that's exactly the weight that the lower scale can "nearly endure". So, as $4 \geq 4$, the scale breaks.

D. Visit of the Great

time limit per test: 3 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

The Great Mushroom King descended to the dwarves, but not everyone managed to see him. Only the few chosen ones could see the King.

We know that only $LCM(k^{2^l}+1, k^{2^{l+1}}+1, ..., k^{2^r}+1)$ dwarves can see the Great Mushroom King. Numbers k, l, r are chosen by the Great Mushroom King himself in some complicated manner which is unclear to common dwarves.

The dwarven historians decided to document all visits of the Great Mushroom King. For each visit the dwarven historians know three integers k_i, l_i, r_i, chosen by the Great Mushroom King for this visit. They also know a prime number p_i. Help them to count the remainder of dividing the number of dwarves who can see the King, by number p_i, for each visit.

Input

The first line contains the single integer t $(1 \le t \le 10^5)$ — the number of the King's visits.

Each of the following t input lines contains four space-separated integers k_i, l_i, r_i and p_i $(1 \le k_i \le 10^6; 0 \le l_i \le r_i \le 10^{18}; 2 \le p_i \le 10^9)$ — the numbers, chosen by the Great Mushroom King and the prime module, correspondingly.

It is guaranteed that for all visits number p_i is prime.

Please do not use the `%lld` specifier to read or write 64-bit integers in C++. It is preferred to use the `cin`, `cout` streams or the `%I64d` specifier.

Output

For each visit print the answer on a single line — the remainder of dividing the number of the dwarves who can see the King this time, by number p_i. Print the answers for the visits in the order, in which the visits are described in the input.

Sample test(s)

input

```
2
3 1 10 2
5 0 4 3
```

output

```
0
0
```

Note

We consider that $LCM(a_1, a_2, ..., a_n)$ represents the least common multiple of numbers $a_1, a_2, ..., a_n$.

We consider that $x^0 = 1$, for any x.

E. Soap Time! - 2

time limit per test: 6 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Imagine the Cartesian coordinate system. There are k different points containing subway stations. One can get from any subway station to any one instantly. That is, the duration of the transfer between any two subway stations can be considered equal to zero. You are allowed to travel only between subway stations, that is, you are not allowed to leave the subway somewhere in the middle of your path, in-between the stations.

There are n dwarves, they are represented by their coordinates on the plane. The dwarves want to come together and watch a soap opera at some integer point on the plane. For that, they choose the gathering point and start moving towards it simultaneously. In one second a dwarf can move from point (x, y) to one of the following points: $(x - 1, y)$, $(x + 1, y)$, $(x, y - 1)$, $(x, y + 1)$. Besides, the dwarves can use the subway as many times as they want (the subway transfers the dwarves instantly). The dwarves do not interfere with each other as they move (that is, the dwarves move simultaneously and independently from each other).

Help the dwarves and find the minimum time they need to gather at one point.

Input

The first line contains two integers n and k $(1 \le n \le 10^5; 0 \le k \le 10^5)$ — the number of dwarves and the number of subway stations, correspondingly.

The next n lines contain the coordinates of the dwarves. The i-th line contains two space-separated integers x_i and y_i $(|x_i|, |y_i| \le 10^8)$ — the coordinates of the i-th dwarf. It is guaranteed that all dwarves are located at different points.

The next k lines contain the coordinates of the subway stations. The t-th line contains two space-separated integers x_t and y_t $(|x_t|, |y_t| \le 10^8)$ — the coordinates of the t-th subway station. It is guaranteed that all subway stations are located at different points.

Output

Print a single number — the minimum time, in which all dwarves can gather together at one point to watch the soap.

Sample test(s)

input

```
1 0
2 -2
```

output

```
0
```

input

```
2 2
5 -3
-4 -5
-4 0
-3 -2
```

output

```
6
```