A. Almost AP

2.0 s, 512 MB

An array, is called an "Almost Arithmetic Progression" (Almost AP) if you can modify at most 3 elements in the array such that it becomes an arithmetic progression.

Recall the definition of the arithmetic progression: For an array $a_1, a_2, \ldots, a_n$ to be an AP, $a_{i+1} - a_i = c$ for all $1 \le i < n$, in which c is a constant (c can be either positive, or negative, or 0).

You are asked to turn an Almost AP into an exact AP by modifying at most 3 numbers.

Input

The first line contains an integer n. ($3 \le n \le 10^5$)

The second line contains n space-separated integers: $a_1, a_2, \ldots, a_n$. ($-10^9 \le a_i \le 10^9$)

Output

Output an arithmetic progression consisting of n integers $b_1, b_2, \ldots, b_n$. Array b differs from array a by at most three numbers. You should also make sure that $|b_i| \le 10^{18}$.

The input guarantees there is at least one solution. If there are multiple of them, you can output any one.

input

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

output

```
1 2 3 4 5
```

input

```
4
1 3 5 7
```

output

```
1 3 5 7
```

input

```
4
2 3 3 3
```

output

```
4 3 2 1
```

Problem B
Pants On Fire

Donald and Mike are the leaders of the free world and haven't yet (after half a year) managed to start a nuclear war. It is so great! It is so tremendous!

Despite the great and best success of Donald's Administration, there are still a few things he likes to complain about.

> The Mexican government is much smarter, much sharper, and much more cunning. And they send all these bad hombres over because they don't want to pay for them. They don't want to take care of them.
>
> Donald J. Trump, First Republican Presidential Debate, August 6, 2015

He also frequently compares `Mexicans` to other bad people (like `Germans`, since they are exporting so many expensive cars to the US). Due to the tremendous amount of statements he has made (mostly containing less than 140 characters ...) the "Fake-News" New York Telegraph (NYT) has to put in a lot of effort to clarify and comment on all the statements of Donald. To check a statement, they have a list of facts they deem to be true and classify Donald's statements into three groups: real facts (which are logical conclusions from their list of true facts), exaggerations (which do not follow, but are still consistent with the papers list of facts), and alternative facts (which contradict the knowledge of the newspaper).

They have asked you to write a program helping them to classify all of Donald's statements – after all it is hard for a journalist to go through them all and check them all, right?

Input

The input consists of:

- one line containing two integers n and m, where
  - n ($1 \leq n \leq 200$) is the number of facts deemed true by the NYT;
  - m ($1 \leq m \leq 200$) is the number of statements uttered by the Donald.
- n lines each containing a statement deemed true by the NYT.
- m lines each containing a statement uttered by the Donald.

All statements are of the form a `are worse than` b, for some strings a and b, stating that a is (strictly) worse than b. The strings a and b are never identical. Both a and b are of length between 1 and 30 characters and contain only lowercase and uppercase letters of the English alphabet.

Note that Donald's statements may contain countries that the NYT does not know about. You may assume that worseness is transitive and that the first n lines do not contain any contradictory statement. Interestingly, Donald's press secretary (Grumpy Sean) has managed to convince him not to make up countries when tweeting, thus the input mentions at most 193 different countries.

Output

For every of the m statements of Donald output one line containing

- `Fact` if the statement is true given the n facts of the NYT
- `Alternative Fact` if the inversion of the statement is true given the n facts of the NYT
- `Pants on Fire` if the statement does not follow, but neither does its inverse.

Sample Input 1

```
4 5
Mexicans are worse than Americans
Russians are worse than Mexicans
NorthKoreans are worse than Germans
Canadians are worse than Americans
Russians are worse than Americans
Germans are worse than NorthKoreans
NorthKoreans are worse than Mexicans
NorthKoreans are worse than French
Mexicans are worse than Canadians
```

Sample Output 1

```
Fact
Alternative Fact
Pants on Fire
Pants on Fire
Pants on Fire
```

Problem C
Buildings

As a traveling salesman in a globalized world, Alan has always moved a lot. He almost never lived in the same town for more than a few years until his heart yearned for a different place. However, this newest town is his favorite yet - it is just so colorful. Alan has recently moved to Colorville, a smallish city in between some really nice mountains. Here, Alan has finally decided to settle down and build himself a home - a nice big house to call his own.

In Colorville, many people have their own houses - each painted with a distinct pattern of colors such that no two houses look the same. Every wall consists of exactly $n \times n$ squares, each painted with a given color (windows and doors are also seen as unique "colors"). The walls of the houses are arranged in the shape of a regular m-gon, with a roof on top. According to the deep traditions of Colorville, the roofs should show the unity among Colorvillians, so all roofs in Colorville have the same color.

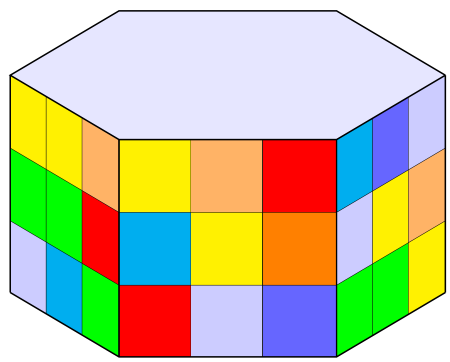

Figure B.1: Example house design for $n = 3$, $m = 6$.

Of course, Alan wants to follow this custom to make sure he fits right in. However, there are so many possible designs to choose from. Can you tell Alan how many possible house designs there are? (Two house designs are obviously the same if they can be translated into each other just by rotation.)

Input

The input consists of:

- one line with three integers n, m, and c, where
  - n ($1 \leq n \leq 500$) is the side length of every wall, i.e. every wall consists of $n \times n$ squares;
  - m ($3 \leq m \leq 500$) is the number of corners of the regular polygon;
  - c ($1 \leq c \leq 500$) the number of different colors.

Output

Output s where s is the number of possible different house designs. Since s can be very large, output $s \mod (10^9 + 7)$.

Sample Input 1	Sample Output 1
`1 3 1`	`1`

Sample Input 2	Sample Output 2
`2 5 2`	`209728`

Problem D
Perpetuum Mobile

The year is 1902. Albert Einstein is working in the patent office in Bern. Many patent proposals contain egregious errors; some even violate the law of conservation of energy. To make matters worse, the majority of proposals make use of non-standard physical units that are not part of the metric system (or not even documented). All proposals are of the following form:

- Every patent proposal contains n energy converters.
- Every converter has an unknown input energy unit associated with it.
- Some energy converters can be connected: If converter a can be connected to converter b such that one energy unit associated with a is turned into c input units for b, then this is indicated by an arc $a \xrightarrow{c} b$ in the proposal. The output of a can be used as input for b if and only if such an arc from a to b exists.

Einstein would like to dismiss all those proposals out of hand where the energy converters can be chained up in a cycle such that more energy is fed back to a converter than is given to it as input, thereby violating the law of conservation of energy.

Einstein's assistants know that he is born for higher things than weeding out faulty patent proposals. Hence, they take care of the most difficult cases, while the proposals given to Einstein are of a rather restricted form: Every *admissible* patent proposal given to Einstein does not allow for a cycle where the total product of arc weights exceeds 0.9. By contrast, every *inadmissible* patent proposal given to Einstein contains a cycle where the the number of arcs constituting the cycle does not exceed the number of converters defined in the proposal, and the total product of arc weights is greater or equal to 1.1.

Could you help Einstein identify the inadmissible proposals?

Input

The input consists of:

- one line with two integers n and m, where
  - n ($2 \leq n \leq 800$) is the number of energy converters;
  - m ($0 \leq m \leq 4000$) is the number of arcs.
- m lines each containing three numbers a_i, b_i, and c_i, where
  - a_i and b_i ($1 \leq a_i, b_i \leq n$) are integers identifying energy converters;
  - c_i ($0 < c_i \leq 5.0$) is a decimal number

  indicating that the converter a_i can be connected to the converter b_i such that one input unit associated with a_i is converted to c_i units associated with b_i. The number c_i may have up to 4 decimal places.

Output

Output a single line containing `inadmissible` if the proposal given to Einstein is inadmissible, `admissible` otherwise.

Sample Input 1

```
2 2
1 2 0.5
2 1 2.3
```

Sample Output 1

```
inadmissible
```

Sample Input 2

```
2 2
1 2 0.5
2 1 0.7
```

Sample Output 2

```
admissible
```

Problem E
Drawing Borders

Somewhere in the great North American plains live the tribes of chiefs *Blue Eagle*, *Red Beaver*, and *Green Serpent*. Their population is scattered over numerous villages all over the land and conflict arises whenever members of different tribes meet while traveling across the plains.

To put an end to the constant animosities the chiefs have decided that the land should be divided between the tribes so that they can avoid each other when moving between villages belonging to the same tribe. More precisely, they want to construct two border fences – thus dividing the land into three regions – such that two villages lie in the same region precisely when they belong to the same tribe.

The villages are represented by points in the Euclidean plane that are colored blue, red or green, depending on the tribe, and the fences should be drawn in the form of two polygons. The polygons may not touch or intersect themselves or each other and none of the points may lie on their boundary. (Make sure to read the constraints in the Output section!)

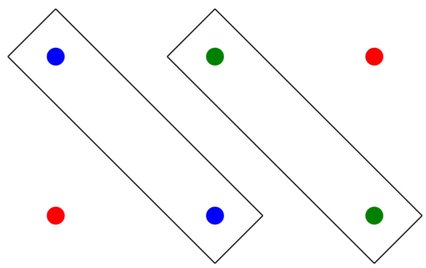

Figure A.1: Illustration of the sample.

Input

The input consists of:

- one line with an integer n ($3 \leq n \leq 100$), the number of villages.
- n lines, each with three integers x, y, c ($-1\,000 \leq x, y \leq 1\,000, 1 \leq c \leq 3$), representing a village at coordinates (x, y) of color c ($1 =$ blue, $2 =$ red, $3 =$ green). All positions are unique. There is at least one village of each color.

Output

If there is no solution, print `impossible`. Otherwise, print the two polygons in the following format:

- one line with an integer m ($3 \leq m \leq 1\,000$), the number of vertices of the polygon.
- m lines, each with two real numbers x, y ($-3\,000 \leq x, y \leq 3\,000$), the vertices of the polygon in either clockwise or counter-clockwise order. The numbers may be given with up to five decimal places (additional places will be rounded off).

Sample Input 1

```
6
0 0 2
0 1 1
1 0 1
1 1 3
2 0 3
2 1 2
```

Sample Output 1

```
4
-0.3 1.0
1.0 -0.3
1.3 0.0
0.0 1.3
4
0.7 1.0
2.0 -0.3
2.3 0.0
1.0 1.3
```

F. XOR

1.0 s, 512 MB

Given n, k, p, Count the number of **non-empty** subsets of $\{0, 1, ..., 2^n - 1\}$ such that the xor-sum of the subset is exactly k. Output the answer modulo p.

Input

Three space-separated integers n, k, p. $(1 \le n \le 10^{18}, 0 \le k \le min(2^n - 1, 10^{18}), 2 \le p \le 10^9, p$ is prime.)

Output

Output an integer denoting the answer.

input
2 3 998244353
output
4

When $n = 2$ and $k = 3$, we have the following 4 possible subsets: $\{1, 2\}$, $\{3\}$, $\{0, 3\}$, $\{0, 1, 2\}$.