A. Harry Potter and Three Spells

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

A long time ago (probably even in the first book), Nicholas Flamel, a great alchemist and the creator of the Philosopher's Stone, taught Harry Potter three useful spells. The first one allows you to convert a grams of sand into b grams of lead, the second one allows you to convert c grams of lead into d grams of gold and third one allows you to convert e grams of gold into f grams of sand. When Harry told his friends about these spells, Ron Weasley was amazed. After all, if they succeed in turning sand into lead, lead into gold, and then turning part of the gold into sand again and so on, then it will be possible to start with a small amount of sand and get huge amounts of gold! Even an infinite amount of gold! Hermione Granger, by contrast, was skeptical about that idea. She argues that according to the law of conservation of matter getting an infinite amount of matter, even using magic, is impossible. On the contrary, the amount of matter may even decrease during transformation, being converted to magical energy. Though Hermione's theory seems convincing, Ron won't believe her. As far as Ron is concerned, Hermione made up her law of conservation of matter to stop Harry and Ron wasting their time with this nonsense, and to make them go and do homework instead. That's why Ron has already collected a certain amount of sand for the experiments. A quarrel between the friends seems unavoidable...

Help Harry to determine which one of his friends is right, and avoid the quarrel after all. To do this you have to figure out whether it is possible to get the amount of gold greater than any preassigned number from some finite amount of sand.

Input

The first line contains 6 integers a, b, c, d, e, f ($0 \le a, b, c, d, e, f \le 1000$).

Output

Print "Ron", if it is possible to get an infinitely large amount of gold having a certain finite amount of sand (and not having any gold and lead at all), i.e., Ron is right. Otherwise, print "Hermione".

Examples

input

```
100 200 250 150 200 250
```

output

```
Ron
```

input

```
100 50 50 200 200 100
```

output

```
Hermione
```

input

```
100 10 200 20 300 30
```

output

```
Hermione
```

input

```
0 0 0 0 0 0
```

output

```
Hermione
```

input

```
1 1 0 1 1 1
```

output

```
Ron
```

input

```
1 0 1 2 1 2
```

output

```
Hermione
```

input

```
100 1 100 1 0 1
```

output

```
Ron
```

Note

Consider the first sample. Let's start with the 500 grams of sand. Apply the first spell 5 times and turn the sand into 1000 grams of lead. Then apply the second spell 4 times to get 600 grams of gold. Let’s take 400 grams from the resulting amount of gold turn them back into sand. We get 500 grams of sand and 200 grams of gold. If we apply the same operations to 500 grams of sand again, we can get extra 200 grams of gold every time. Thus, you can get 200, 400, 600 etc. grams of gold, i.e., starting with a finite amount of sand (500 grams), you can get the amount of gold which is greater than any preassigned number.

In the forth sample it is impossible to get sand, or lead, or gold, applying the spells.

In the fifth sample an infinitely large amount of gold can be obtained by using only the second spell, which allows you to receive 1 gram of gold out of nothing. Note that if such a second spell is available, then the first and the third one do not affect the answer at all.

The seventh sample is more interesting. We can also start with a zero amount of sand there. With the aid of the third spell you can get sand out of nothing. We get 10000 grams of sand in this manner. Let's get 100 grams of lead using the first spell 100 times. Then make 1 gram of gold from them. We managed to receive 1 gram of gold, starting with a zero amount of sand! Clearly, in this manner you can get an infinitely large amount of gold.

B. Harry Potter and the History of Magic

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

The History of Magic is perhaps the most boring subject in the Hogwarts school of Witchcraft and Wizardry. Harry Potter is usually asleep during history lessons, and his magical quill writes the lectures for him. Professor Binns, the history of magic teacher, lectures in such a boring and monotonous voice, that he has a soporific effect even on the quill. That's why the quill often makes mistakes, especially in dates.

So, at the end of the semester Professor Binns decided to collect the students' parchments with notes and check them. Ron Weasley is in a panic: Harry's notes may contain errors, but at least he has some notes, whereas Ron does not have any. Ronald also has been sleeping during the lectures and his quill had been eaten by his rat Scabbers. Hermione Granger refused to give Ron her notes, because, in her opinion, everyone should learn on their own. Therefore, Ron has no choice but to copy Harry's notes.

Due to the quill's errors Harry's dates are absolutely confused: the years of goblin rebellions and other important events for the wizarding world do not follow in order, and sometimes even dates from the future occur. Now Ron wants to change some of the digits while he copies the notes so that the dates were in the chronological (i.e. non-decreasing) order and so that the notes did not have any dates strictly later than 2011, or strictly before than 1000. To make the resulting sequence as close as possible to the one dictated by Professor Binns, Ron will change no more than one digit in each date into other digit. Help him do it.

Input

The first input line contains an integer n ($1 \le n \le 1000$). It represents the number of dates in Harry's notes. Next n lines contain the actual dates y_1, y_2, ..., y_n, each line contains a date. Each date is a four-digit integer ($1000 \le y_i \le 9999$).

Output

Print n numbers z_1, z_2, ..., z_n ($1000 \le z_i \le 2011$). They are Ron's resulting dates. Print each number on a single line. Numbers z_i must form the non-decreasing sequence. Each number z_i should differ from the corresponding date y_i in no more than one digit. It is not allowed to change the first digit of a number into 0. If there are several possible solutions, print any of them. If there's no solution, print "No solution" (without the quotes).

Examples

input
```
3
1875
1936
1721
```
output
```
1835
1836
1921
```

input
```
4
9999
2000
3000
3011
```
output
```
1999
2000
2000
2011
```

input
```
3
1999
5055
2000
```
output
```
No solution
```

C. Harry Potter and the Golden Snitch

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

Brothers Fred and George Weasley once got into the sporting goods store and opened a box of Quidditch balls. After long and painful experiments they found out that the Golden Snitch is not enchanted at all. It is simply a programmed device. It always moves along the same trajectory, which is a polyline with vertices at the points (x_0, y_0, z_0), (x_1, y_1, z_1), ..., (x_n, y_n, z_n). At the beginning of the game the snitch is positioned at the point (x_0, y_0, z_0), and then moves along the polyline at the constant speed v_s. The twins have not yet found out how the snitch behaves then. Nevertheless, they hope that the retrieved information will help Harry Potter and his team in the upcoming match against Slytherin. Harry Potter learned that at the beginning the game he will be at the point (P_x, P_y, P_z) and his super fast Nimbus 2011 broom allows him to move at the constant speed v_p in any direction or remain idle. v_p is not less than the speed of the snitch v_s. Harry Potter, of course, wants to catch the snitch as soon as possible. Or, if catching the snitch while it is moving along the polyline is impossible, he wants to hurry the Weasley brothers with their experiments. Harry Potter catches the snitch at the time when they are at the same point. Help Harry.

Input

The first line contains a single integer n ($1 \le n \le 10000$). The following $n+1$ lines contain the coordinates x_i, y_i, z_i, separated by single spaces. The coordinates of any two consecutive points do not coincide. The next line contains the velocities v_p and v_s, the last line contains P_x, P_y, P_z, separated by single spaces. All the numbers in the input are integers, their absolute value does not exceed 10^4. The speeds are strictly positive. It is guaranteed that $v_s \le v_p$.

Output

If Harry Potter can catch the snitch while it is moving along the polyline (including the end (x_n, y_n, z_n)), print "YES" in the first line (without the quotes). Print in the second line t, which is the earliest moment of time, when Harry will be able to catch the snitch. On the third line print three numbers X, Y, Z, the coordinates of the point at which this happens. The absolute or relative error in the answer should not exceed 10^{-6}. If Harry is not able to catch the snitch during its moving along the described polyline, print "NO".

Examples

input

```
4
0 0 0
0 10 0
10 10 0
10 0 0
0 0 0
1 1
5 5 25
```

output

```
YES
25.5000000000
10.0000000000 4.5000000000 0.0000000000
```

input

```
4
0 0 0
0 10 0
10 10 0
10 0 0
0 0 0
1 1
5 5 50
```

output

```
NO
```

input

```
1
1 2 3
4 5 6
20 10
1 2 3
```

output

```
YES
0.0000000000
1.0000000000 2.0000000000 3.0000000000
```

D. Harry Potter and the Sorting Hat

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

As you know, Hogwarts has four houses: Gryffindor, Hufflepuff, Ravenclaw and Slytherin. The sorting of the first-years into houses is done by the Sorting Hat. The pupils are called one by one in the alphabetical order, each of them should put a hat on his head and, after some thought, the hat solemnly announces the name of the house the student should enter.

At that the Hat is believed to base its considerations on the student's personal qualities: it sends the brave and noble ones to Gryffindor, the smart and shrewd ones — to Ravenclaw, the persistent and honest ones — to Hufflepuff and the clever and cunning ones — to Slytherin. However, a first year student Hermione Granger got very concerned about the forthcoming sorting. She studied all the literature on the Sorting Hat and came to the conclusion that it is much simpler than that. If the relatives of the student have already studied at Hogwarts, the hat puts the student to the same house, where his family used to study. In controversial situations, when the relatives studied in different houses or when they were all Muggles like Hermione's parents, then the Hat sorts the student to the house, to which the least number of first years has been sent at that moment. If there are several such houses, the choice is given to the student himself. Then the student can choose any of the houses, to which the least number of first years has been sent so far.

Hermione has already asked the students that are on the list before her about their relatives. Now she and her new friends Harry Potter and Ron Weasley want to find out into what house the Hat will put Hermione.

Input

The first input line contains an integer n ($1 \le n \le 10000$). It is the number of students who are in the list before Hermione. The next line contains n symbols. If all the relatives of a student used to study in the same house, then the i-th character in the string coincides with the first letter of the name of this house. Otherwise, the i-th symbol is equal to "?".

Output

Print all the possible houses where Hermione can be sent. The names of the houses should be printed in the alphabetical order, one per line.

Examples

input

```
11
G????SS???H
```

output

```
Gryffindor
Ravenclaw
```

input

```
2
H?
```

output

```
Gryffindor
Ravenclaw
Slytherin
```

Note

Consider the second example. There are only two students before Hermione. The first student is sent to Hufflepuff. The second disciple is given the choice between the houses where the least number of students has been sent, i.e. Gryffindor, Slytherin and Ravenclaw. If he chooses Gryffindor, Hermione is forced to choose between Ravenclaw and Slytherin, if he chooses Ravenclaw, Hermione will choose between Gryffindor and Slytherin, if he chooses Slytherin, Hermione will choose between Gryffindor and Ravenclaw. In the end, the following situation is possible (it depends on the choice of the second student and Hermione). Hermione will end up 1) in Gryffindor, 2) in Ravenclaw, 3) in Slytherin. Note that, despite the fact that in neither case Hermione will be given a choice between all the three options, they are all possible and they should all be printed in the answer. Hermione will not, under any circumstances, end up in Hufflepuff.

E. Harry Potter and Moving Staircases

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

Harry Potter lost his Invisibility Cloak, running from the school caretaker Filch. Finding an invisible object is not an easy task. Fortunately, Harry has friends who are willing to help. Hermione Granger had read "The Invisibility Cloaks, and Everything about Them", as well as six volumes of "The Encyclopedia of Quick Search of Shortest Paths in Graphs, Network Flows, the Maximal Increasing Subsequences and Other Magical Objects". She has already developed a search algorithm for the invisibility cloak in complex dynamic systems (Hogwarts is one of them).

Hogwarts consists of n floors, numbered by integers from 1 to n. Some pairs of floors are connected by staircases. The staircases may change its position, moving exactly one end. Formally the situation is like this: if a staircase connects the floors a and b, then in one move it may modify its position so as to connect the floors a and c or b and c, where c is any floor different from a and b. Under no circumstances the staircase can connect a floor with itself. At the same time there can be multiple stairs between a pair of floors.

Initially, Harry is on the floor with the number 1. He does not remember on what floor he has lost the cloak and wants to look for it on each of the floors. Therefore, his goal is to visit each of n floors at least once. Harry can visit the floors in any order and finish the searching at any floor.

Nowadays the staircases move quite rarely. However, Ron and Hermione are willing to put a spell on any of them to help Harry find the cloak. To cause less suspicion, the three friends plan to move the staircases one by one, and no more than once for each staircase. In between shifting the staircases Harry will be able to move about the floors, reachable at the moment from the staircases, and look for his Invisibility Cloak. It is assumed that during all this time the staircases will not move spontaneously.

Help the three friends to compose a searching plan. If there are several variants to solve the problem, any valid option (not necessarily the optimal one) will be accepted.

Input

The first line contains integers n and m ($1 \le n \le 100000$, $0 \le m \le 200000$), which are the number of floors and staircases in Hogwarts, respectively. The following m lines contain pairs of floors connected by staircases at the initial moment of time.

Output

In the first line print "YES" (without the quotes) if Harry is able to search all the floors, and "NO" otherwise. If the answer is positive, then print on the second line the number of staircases that Ron and Hermione will have to shift. Further output should look like this:

```
Harry's moves

a staircase's move

Harry's moves

a staircase's move

...

a staircase's move

Harry's moves
```

Each "`Harry's move`" should be represented as a list of floors in the order in which they have been visited. **The total amount of elements of these lists must not exceed 10^6.** When you print each list, first print the number of elements in it, and then in the same line print the actual space-separated elements. The first number in the first list should be the number 1 (the floor, from which Harry begins to search). Any list except the first one might contain the zero number of elements. Note that Harry can visit some floors again, but must visit all n floors at least once. Two consecutively visited floors must be directly connected by a staircase (at the time Harry goes from one of them to the other one). **No two floors that are visited consequtively can be equal.**

In the description of a "`staircase's move`" indicate the number of staircase (the staircases are numbered from 1 to m in the order in which they are given in the input data) and its new location (two numbers of the connected floors in any order).

Any staircase can be moved at most once. If there are several solutions, output any.

Examples

input

```
6 4
1 2
1 3
2 3
4 5
```

output

```
YES
2
3 1 2 3
2 3 5
3 5 4 5
4 5 6
3 6 5 3
```

input

```
4 1
1 2
```

output

```
NO
```

input

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

output

```
YES
0
6 1 2 1 3 4 5
```