COCI 2018/2019

Round #4, January 19th, 2019

Tasks

Task	Time limit	Memory limit	Score
Elder	1 s	64 MB	50
Wand	1 s	64 MB	70
Kisik	2 s	128 MB	90
Slagalica	1 s	64 MB	110
Akvizna	1.5 s	256 MB	130
Total			450

After having watched all eight Harry Potter movies in a week, Nikola finally realized how the famous Elder Wand changes the wizard it obeys. If wizard *A*, whom the wand is currently obeying, is defeated by wizard *B* in a duel, then the wand will start obeying the wizard *B*.

Nikola is now wondering what would happen if 26 wizards labeled with upper case letters of the English alphabet from "A" to "Z" began fighting in duels for the fondness of the Elder Wand. If we know the label of the wizard that the wand had obeyed before all duels and the outcomes of all *N* duels that were held one after another, answer the following questions:

1. Which wizard did the wand obey after all *N* duels?
2. How many different wizards did the wand obey?

INPUT

The first line contains an uppercase letter of the English alphabet, the label of the wizard that the wand obeyed at the beginning.
The second line contains an integer number N ($1 \le N \le 100$), the number of duels from the text of the task.
In the next N rows there are two different uppercase letters of the English alphabet $Z1$ and $Z2$ separated by a space, whereas the wizard with the label $Z1$ defeated the wizard with the label $Z2$ in the i^{th} duel.

OUTPUT

In the first line print an uppercase letter of the English alphabet, answer to the first question from the task description.
In the second line print an integer number, answer to the second question from the task description.

SCORING

Correct answer to the first question is worth 2 points and the correct answer to the second question is worth 3 points. If you do not know how to solve some part of the task, then print any value in the corresponding line.

SAMPLE TESTS

input	input	input
A 3 B A C B D A	N 5 D A N B B A C D F A	X 4 A X B X X A D A
output	**output**	**output**
C 3	N 1	X 2

Clarification of the first sample:
Before the first duel, the Elder Wand obeyed wizard A. After the first duel, it obeyed wizard B, and after the second wizard C. The third duel didn't change anything.

Kile really liked Nikola's task with wizards and a wand (see task *Elder*) so he decided to make his own version. He imagined that instead of the 26 wizards there are N of them labeled with integers from 1 to N and that M duels must be held among the wizards. It is possible that a duel between the same pair of wizards will be held multiple times.

As in Nikola's task, if before the match the wand belonged to the loser, after the match the wand will be assigned to the winner.

If we know in advance for each duel which pair of wizards will fight, as well as which of them will win and if we **can choose the order** in which the duels will be held, then Kile wants to know in whose hands the wand can end up in after **all *M*** duels.

In the beginning, the wand belongs to the wizard with the label 1.

INPUT

The first line contains two integers N and M ($1 \le N, M \le 100\ 000$).
In the following M lines there are two numbers X_i and Y_i ($1 \le Xi, Yi \le N, Xi \ne Yi$). The wizard X_i will win the fight against wizard Y_i.

OUTPUT

Print N characters in the first and only line. The character at the k^{th} position should be '1' if the wizard labeled with k can rule over the wand after all M duels and '0' otherwise.

SCORING

In the sample tests totally worth 20% of points it will be true that $1 \le N, M \le 10$.

SAMPLE TESTS

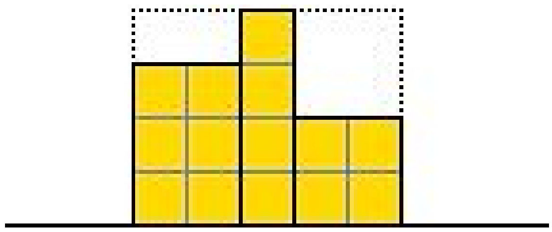
input	input	input
3 2 2 3 3 1	2 2 2 1 1 2	5 5 3 1 2 1 4 3 4 5 2 5
output	**output**	**output**
011	11	01110

Clarification of the first test:
If wizards 1 and 3 fight first, and wizards 2 and 3 fight second, the wand will belong to wizard 2.
If wizards 2 and 3 fight first, and wizards 1 and 3 fight second, the wand will belong to wizard 3.

The Colonial Alliance of Intergalactic Nations (CAIN) has decided to build a town on Mars for K families. It is therefore necessary to build a total of K buildings, one for each family. For each family, one of N different building designs that were prepared by the best architects in the universe will be selected. All buildings are of rectangular shape, and the i^{th} building is W_i units wide and H_i units high. In addition, due to the variety promoted by CAIN, all families will get **different** designs.

Buildings are built next to each other, so that their bottom sides lie on the same line. After construction, the city needs to be filled with air, so the city will be enclosed by a huge glass wall that will keep the air inside. The wall will also be of a rectangular shape with sides parallel to the building sides.

Since maintaining air on Mars is expensive, your job is to choose a single assignment between all possible ones in a way that will require the least amount of air (one unit of air is required to supply unit sized square).



A possible city from the first sample test, which only needs 20 air units.
We chose not to build the building which is 3 units wide.

INPUT

The first line contains two integers N and K from the task description ($1 \le K \le N \le 1\,000\,000$).
In the next N lines there are two integer numbers W_i and H_i, width and height of the i^{th} building ($1 \le W_i, H_i \le 1\,000\,000$). All the pairs ($W_i$, H_i) will be mutually different.

OUTPUT

Write the minimum amount of air in the first line.

SCORING

In the test samples totally worth 40 points N will be less than or equal to 1 000.

SAMPLE TESTS

input

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

output

```
20
```

input

```
3 3
1 1
3 3
2 2
```

output

```
18
```

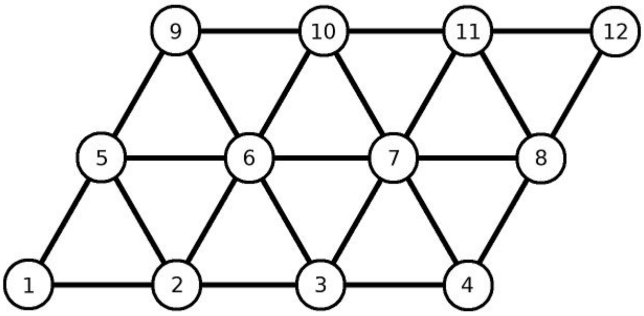
input

```
4 1
6 4
4 5
19 1
3 6
```

output

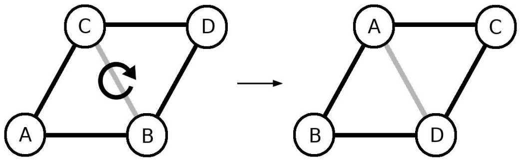
```
18
```

Since he learnt how to solve the Rubik's cube, Jurica has also been interested in other puzzles of this kind and he recently created an enigmatic toy himself. We can imagine Jurica's puzzle as a triangular net in the form of a parallelogram whose nodes are arranged in *N* rows and *M* columns. The rows are labeled from 1 to *N* **from the bottom up**, and the columns are labeled 1 to *M* **from left to right**. Each node is denoted by coordinates (*x*, *y*), where *x* is the row and *y* is the column. Each node has a unique integer value between 1 and *N·M* written in it, and the puzzle is considered solved when the first row contains numbers from 1 to *M* ordered from left to right, the second row contains numbers from *M*+1 to 2*M* in the same order, etc. The picture below shows a solved puzzle of 3 rows and 4 columns.

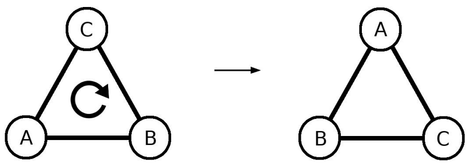


The layout of the puzzle can be changed in two ways:

1. By selecting the unit sized rhombus whose nodes are determined by the coordinates (*x*, *y*), (*x*+1, *y*), (*x*+1, *y*+1) and (*x*, *y*+1), and rotating the node values in the clockwise direction.



2. By selecting a unit sized equilateral triangle whose nodes are determined by the coordinates (x, y), (x+1, y) and (x, y+1) and rotating of the node values in the clockwise direction.



On one boring day, Jurica scrambled the puzzle, writing down the moves he had made on a piece of paper. This sequence of moves he called a mega-move, and explained the application of mega-move as the sequential application of the moves written on the paper. After that, he has repeatedly made the same mega-move several times. He noticed an unusual regularity soon. Starting from a solved puzzle, after exactly K mega-moves, the puzzle will again be solved (the first time since applying the mega-moves).

For given integers *N*, *M* and *K*, determine if there is a mega-move that will allow Jurica to solve the puzzle after exactly *K* repetition of that mega-move, and if so, print that sequence of moves. **Note**: The solution is not necessarily unique and does not have to be optimal in the number of the moves, but the number of moves is limited (see section *Input*).

INPUT

The first line contains three integers N, M ($2 \le N, M \le 100$) and K ($2 \le K \le 10^{12}$), the numbers from the task description.

OUTPUT

If there is not such a mega-move that meet the conditions from the task, print -1 in the only line.
Otherwise, print the number of moves B ($1 \le B \le 500\,000$) in the first line and in the following B lines one move in the following form:

- "R x y" (without the quotation marks) if it is a rotation of a rhombus (operation 1), or
- "T x y" (without the quotation marks) if it is a rotation of an equilateral triangle (operation 2),

whereas the coordinate (x, y) represents the bottom left node of the rhombus or the triangle and it holds that $1 \le x < N$ and $1 \le y < M$.

SCORING

In the test samples worth 40% of the points it will hold that N, $M \le 3$ and $K \le 20$.

SAMPLE TESTS

input	input	input
2 3 2	3 3 12	5 4 116
output	**output**	**output**
5 R 1 1 R 1 1 T 1 1 T 1 1 T 1 1	3 R 1 1 T 2 2 T 2 1	-1

1 vs. 100 is a quiz that we could follow on TVs a few years ago. For the purposes of this task, we will slightly simplify the quiz rules.

The contestant answers questions and has to throw out 100 people who compete against him. Everyone responds to the same question in each round and those who answer the question wrong are thrown out. The amount of money that a competitor who manages to throw out all 100 opponents gets is equal to the sum of money won per round. In each round, all opponents are worth equally and all opponents combined are worth 100 000 kunas (Croatian currency). The amount earned in a round is equal to the sum of the values of people who have been thrown out in that round. For example, if there are 10 opponents at some point, each of them is worth 10 000 kunas, and the contestant will get 30 000 kunas if he or she manages to throw out 3 opponents in that round.

Let's say that the quiz is called 1 vs. N (i.e. the competitor competes against N people) and that Mirko M. managed to throw all the opponents in exactly K rounds. What is the maximum amount he could have won?

INPUT

In the only line there are the integer numbers N ($1 \le N \le 100\ 000$) and K ($1 \le K \le N$), the numbers from the task description.

OUTPUT

Print the maximum possible amount that Mirko M. could have won **divided by 100 000**.
Your answer will be considered correct if relative or absolute difference from the official answer is at **most 10^{-8}**.

SCORING

In the sample tests totally worth 20 points it will be true that $N \le 100$.
In the sample tests totally worth additional 45 points it will be true that $N \le 3\ 000$.

SAMPLE TESTS

input	input	input
5 3	10 10	100 10
output	**output**	**output**
2.100000000	2.928968254	4.590928516

Clarification of first sample test:
Mirko M. played against five players that he threw out in three rounds.
In order to win the maximum possible amount, firstly, he had to throw out three opponents and then two more times one at a time.
In that case, the amount won is equal to $(3/5 + 1/2 + 1/1) \cdot 100\ 000 = 2.1 \cdot 100\ 000 = 210\ 000$ kunas.