Problem A. SQUARES AND UNITS

Input file: standard input
Output file: standard output
Time limit: 400 ms
Memory limit: 256 megabytes

The Lady adores math, but even more she likes to multiply, subtract, add, divide, raise to the square and take the root of a number. Today the Lady is in a special mood and she is engaged in an interesting business - he raises all integers to the square.

The Mister observed this process and decided to join this difficult task. He immediately said that his favorite number is 1 and, therefore, he wants the Lady to raise to the square only the numbers that consist of ones.

Help the Lady find the square of a number consisting of **n** ones, because the Lady may have to spend a lot of time on this task!

Input data:

The incoming file has a single row with an integer **n** ($1 \le \mathbf{n} \le 10^5$).

Output data:

The outcoming file must have one row with the answer to the problem.

Example of incoming file:

4

Example of outcoming file:

1234321

Explanation to the example:

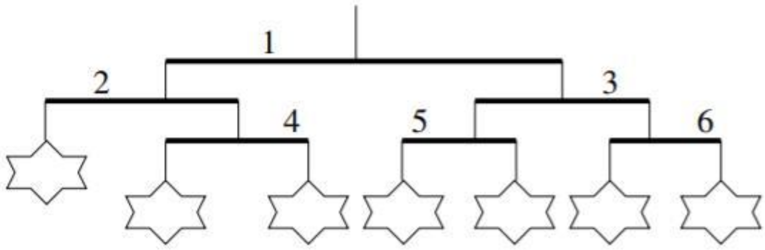
1111 * 1111 = 1234321

Problem B. THE GIFT

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

For her birthday Lady has received a gift from Mister – garland. However, Lady did not like the garland and wanted to change it a bit.

Garland is a multilayered toy that is hung by a cord at the top. Garland is composed of nodes connected by vertical cords. Each node has two cords diverge form it: one to the left and one to the right. Each cord ends either in another node or in a lightbulb. **Level of the lightbulb** is the number of cords that separates this lightbulb from the topmost node. An example of such garland can be seen here:



From the picture we can see that the main (topmost) node from which the garland starts is marked as 1. From the node number 1 the cord diverts to the left to the node number 2 and to the right to the node number 3. Same for the rest of the nodes. For example, from the node number 2 a cord diverts to the left leading to a lightbulb and another cord diverts to the right leading to another node. Both cord from the node number 5 lead to lightbulbs. The leftmost lightbulb's level is 2 (one cord from the 1st to the 2^{nd} node and one more from the 2^{nd} node to the lightbulb). The level of the 4-th lightbulb from the left is 3, like the rest, except the leftmost.

Lady wants to change the garland to her liking. Lady will like the garland and it will be deemed **good** if two conditions are met

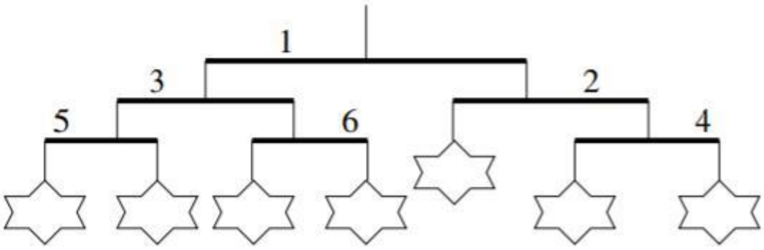
- Every two lightbulbs must be placed at the same level or differ at the most by one level (so the difference should not be more than on level)
- For any pair of two lightbulbs what have a one level difference the higher level (the lower in two) should be placed to the left from the one with the lower level (the one that is placed higher)

Changing the garland can be done via **swapping.** Swapping is conducted in two steps:

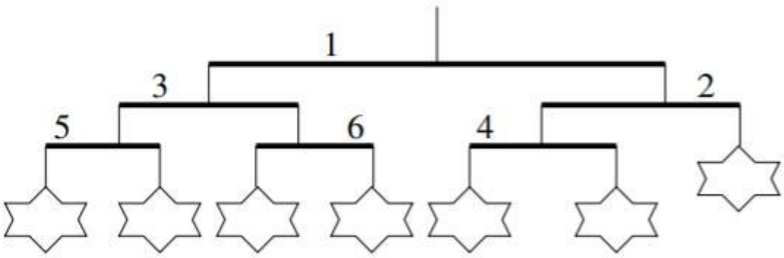
- Chose the node that is going to be swapped.

- Swap the left and the right cords of this node meaning all the following nodes to the left of the node will now be placed to the right and vice versa. This process does not affect any nodes and lightbulbs that are placed at lower levels.

Let us look at the garland below provided as an example. Lady does not like this garland because it violates the second condition (even though it satisfies the first condition). But it can be transformed into a **good** garland. It can be done by performing two swaps. First swap should be done to the first node. The nodes number 2 and 3 are swapped and after this the garland has the following scheme:



The second target should be the node number two. The lightbulb to the left of the node is swapped with the node number 4.



This garland satisfies both conditions and, therefore, is a **good** garland.

Lady does not have time to change the garland herself and wants to start playing with it as soon as possible. You have to help Lady change the garland in the minimal number of steps possible, if it is possible at all. Otherwise you have to state that it is impossible to change the garland so Lady will like it in any number of steps.

Input data:

The first row of the input file has one integer **n** ($1 \le n \le 10^5$) which represents the number on the nodes. The nodes are numbered from 1 to **n.** The following **n** rows describe the cords for each node from 1 to **n**. i+1 row of the input file describes the cords for the node marked as **i.** Each of these rows contains two integers **l** and **r** divided by a spacing that mark nodes or lightbulbs that are hung by the cords to the left or to the right respectively. **l** or **r** are equal to -1 means placement of a lightbulb. Otherwise the respective cord lead to a node with the number **l** or **r**. It is granted that the nodes situated lower have higher numbers than the node it is attached to. The node number 1 is the topmost node by which the garland is attached at the top.

Output data:

The output file must consist of one row that has to contain a single digit. If the garland cannot be transformed into a **good** one the output has to be -1. Otherwise the row has to contain an integer which equals to the smallest number of operations required to transform the garland.

Input file example:

4

2 3

-1 -1

4 -1

-1 -1

Output file example:

1

Example explanation:

It is enough to perform one swap for the node 1 (by swapping the nodes number 2 and number 3).

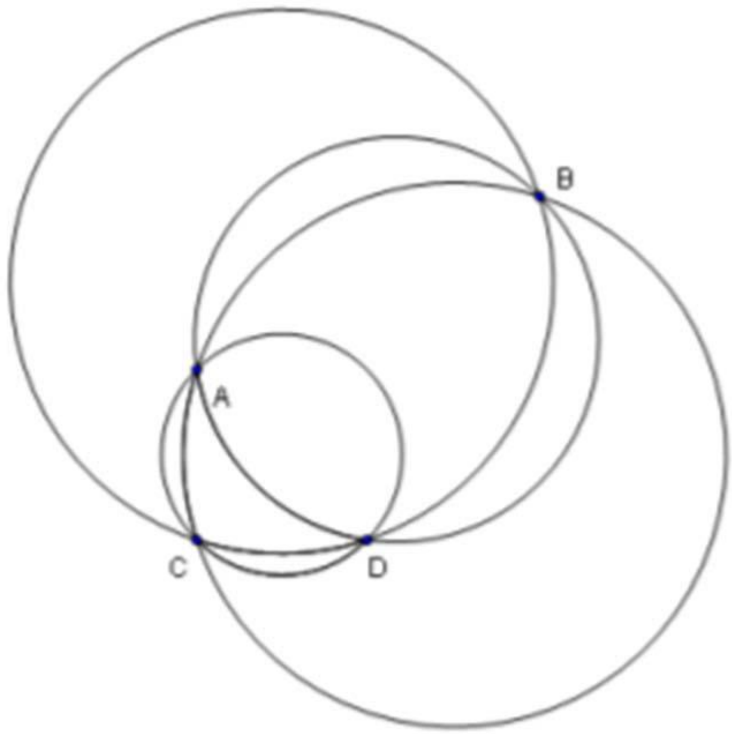
Problem C. CIRCLES

Input file:	standard input
Output file:	standard output
Time limit:	2 second
Memory limit:	256 megabytes

The Mister received a very important problem in Geometry from his Math teacher. He had been thinking a lot, but he could not solve it and asked the Lady for help. The Lady adores Math, but this problem has become too complicated for her. Help The Lady and the Mister to solve their problem.

N points are given on the square. To place a circle, three of the points are selected, and then a circle is constructed using these three points. Data is considered by the number of points from the data that is located on or on the verge of “covered” points. The problem is to calculate the average number of covered points among all possible three-points choices.

For example, let there be 4 points: A,B,C,D. They are located as shown in the figure.



There are only 4 options to choose 3 points. If you select the circle ABC or BCD, 4 points will be covered. If you choose ACD or ABD, then only 3 points will be covered. Therefore, the average number of covered ones is: (4+4+3+3)/4 =3.5

Your task is to calculate this average number, by knowing all the locations of the points.

The input data:

The first row of input data contains one natural number **n** – the total number of points

(**$3 \leq n \leq 1500$**).

The following n rows describe the location of the points. Points are given in a 2-dimentional coordinate systems, where all the points have integer coordinates.

There are no three points located on the straight line, and no four points are on the same circle.

For i from 1 to **n**, the coordinates of the point are given by a pair of integers x_i and y_i in

i+1 row of the input file separated by spaces ($-10^6 \leq x_i, y_i \leq 10^6$).

The output data:

You need to find one number, which means the average number of covered points.

Absolute error of the result should be less than or equal to 0.01.

The examples of the input file:

4

0 0

4 4

2 0

0 2

The examples of the output file:

3.500

The explanation for the example:

This example is given in the data of the problem.

Problem D. SUM

Input file: standard input

Output file: standard output
Time limit: 400 ms
Memory limit: 256 megabytes

The Lady loves Math. On a special day like today, the Lady decided to experiment, of course, with the Mister.

Let the Lady has a sequence, consisting of **n** integer numbers, nonnegative numbers. She counts for such a sequence the number **m** - the minimal number which can not be represented as an algebraic sum of some numbers in the sequence. For example, we find the number **m** for the sequence (2, 3, 5):

- 1 = 3-2
- 2=2
- 3=3
- 4=5+2-3
- 5=5
- 6=5-2+3
- 7=5+2
- 8=5+3
- 9 - the smallest number that can not be represented, therefor **m** for the sequence (2, 3, 5) equals 9.

The Mister knows for sure that when the Lady finds this number **m**, he always rejoices if this number **m** is sufficiently large. Therefore, he wants to find a sequence of length **n** so that the number **m** is maximal. Help him.

Input data:
There is a number in the input file **N (1≤N≤20).**

Output data:
Output **N** numbers in the output file – the elements of the found sequence, arranged in order of growth. Each number should be displayed in a separate row.

An Input file example
2

An Output file example
1
3

Problem E. THE FESTIVE DINNER

Input file:	standard input
Output file:	standard output
Time limit:	2 second
Memory limit:	256 megabytes

The Lady, the Mister and their other friends are celebrating today, and they are organizing a festive dinner. The Lady is responsible for it. In total, **n** people will come on holiday, including the Lady and the Mister. All friends will sit at a round table with **c** seats and, correspondingly, with **c** dishes placed clockwise in a circle. After the **c-th** meal, the first meal comes.

The lady has somehow put the friends in their places: the **i-th** person will sit at the $\mathbf{e_i}$ **-th** position, and will be able to eat exactly 5 dishes, starting with $\mathbf{e_i}$. It is possible that some people will sit in one position. One dish can be eaten by some number of people.

The lady forgot to ask all friends where they would like to sit and what to eat, so now not all people are satisfied with their position. That is to say, people might like some dishes which they will eat, although they might dislike some. Every person except **ei**, knows the list of dishes that he/she loves and the list of dishes he/she hates. The person is neutral towards the rest of the dishes. Everyone is indifferent to all the dishes that he/she can not try (Except for the 5 chosen for him/her).

The Mister has to correct the Lady's mistakes. He can remove some dishes from the table to make people happy. This is a very responsible task - if you remove too many dishes, people will have nothing to eat. The Mister's task is to remove some dishes so that the maximum number of people is happy.

A person is satisfied and happy if one of two conditions is fulfilled:

- At least one of the dishes that this person hates will be removed
- At least one of the dishes that this person loves will be left

Help the Mister choose the dishes to be removed so that the maximum number of people is happy and find this number. For a better understanding of the task, consider the explanation to the input example.

Input data:

The first row contains two numbers **c** and **n**, where **c** is the number of the dishes on the table (**10 ≤ c ≤ 10 000**), and **n** is the number of friends on the celebration

(**1 ≤ n ≤ 50 000**). The dishes are numbered 1, 2, .. **c** clockwise in a circle. Then there are **n** rows, each of the rows describe one person. Each of these rows will be in the format of:

$$e\ f\ p\ x_1\ x_2\ \dots\ x_f\ y_1\ y_2\ \dots\ y_p$$

This means

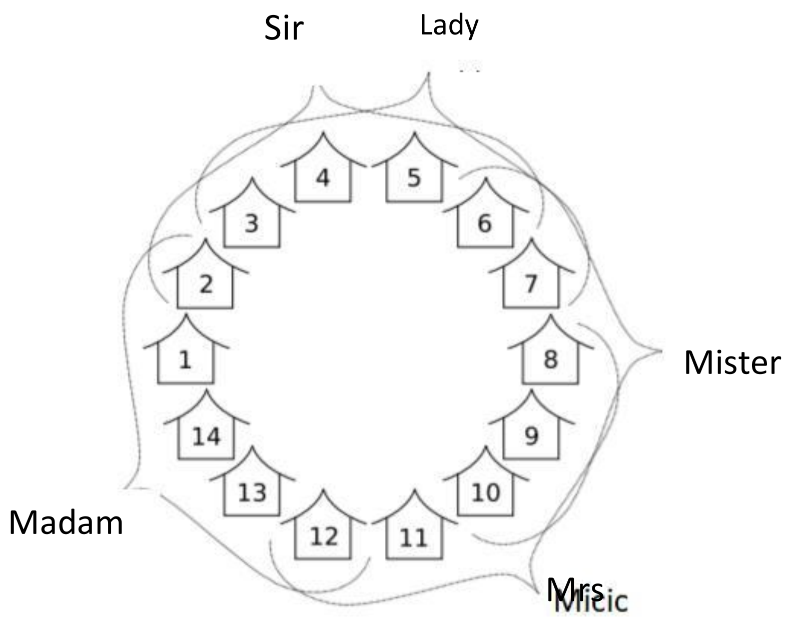
- - **e**: the dish near which this person sits. It means, the person can taste dishes **e**, **e+1, e+2, e+3, e+4**. Note that the numbers that exceed **c** are moved to the beginning of the circle. That is, **c = 14**, **e = 13**, then a person can try dishes 13, 14, 1, 2 and 3, correspondingly.
- - **f**: the quantity of the dishes that this person dislikes
- - **p**: the quantity of the dishes that this person likes
- - $\mathbf{x_1\ x_2\ ...\ x_f}$ - the numbers of the dishes that this person dislikes
- - $\mathbf{y_1\ y_2\ ...\ y_p}$ - the numbers of the dishes that this person enjoys

Please note that more than one person might have the same first **e** dish.

Output data: Output a single row that must contain the solution to the task.

An input file example 1:
14 5
2 1 2 4 2 6
3 1 1 6 4
12 3 0 12 3 2
8 1 1 9 12
6 1 2 9 6 8
An output file example 1:
5

An explanation for the example:



Person	Dishes that eats	Dishes that hates	Dishes that cikes
Sir	2, 3,4,5,6	4	2, 6
Lady	3, 4, 5, 6, 7	6	4
Madam	12, 13, 14, 1, 2	12, 13, 2	-
Mrs	8, 9, 10, 11, 12	9	12
Mister	6, 7, 8, 9, 10	9	6, 8

The picture shows the input example. Suppose, the Mister will remove the dishes 4 and 12. This will make the Sir and the Madame happy (because they did not like one of these dishes). The Mister will also be happy, because neither 6 nor 8 has been removed. But neither the Lady nor the Mrs. will be happy because they will not be able to taste any dishes that they like, and all the dishes they dislike, will remain on the table. This Mister`s decision makes 3 people happy.

Suppose, the Master will remove the dishes 4 and 6. Everyone will be happy except for the Madame: all the dishes that she does not like will remain on the table.

Finally, let's suppose that the Mister will only remove food 13. The Madame will be happy because the Mister removed one meal that she does not like. The rest of the people will be happy, because they will still be able to taste at least one dish they like.

An input file example 2:
12 7
1 1 1 1 5
5 0 3 5 7 9
5 1 1 5 7
7 1 1 7 9
9 3 0 9 11 1
9 1 1 9 11
11 1 1 11 1

An output file example 2:
6

An explanation for the problem:

It is impossible for the Mister to make all people happy, only 6 of them.

Problem F. TOYS

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

The Lady, like a cautious girl, saves all her **n** toys in the box. Imagine the Lady's room as a coordinate line. The box is in the **0** coordinate. When the Mister was with her guest, he scattered all toys. Now the toy with the number **i** is in the coordinate x_i for all **i** from **1** to **n.**

The Lady did not like such a mess, but she decided to use the situation in her favor and check the Mister for his wit. The Lady came up with the following game: she gives the Mister **k** the ropes and asks him to connect some pairs of toys. But there are some restrictions on the connection:

- Each toy can be connected only with one other toy, or not to be connected at all (it is obtained **k** pairs of interconnected toys).
- The length of the rope connecting two toys is with the numbers **i** and **j** must be $|x_i - x_j|$ that is equal to the difference in the coordinates of toys.
- The Lady requires the Mister to choose a pair in such a way that the total length of the rope is minimal.

The Mister is a smart guy, but the solution of this problem was a big question for him. Help him to find the minimum total length of the rope.

Input data:

The first row of input data contains integers **n** and **k** characterizing the number of toys in the Lady's room **n** $(1 \le n \le 10^5)$ and the number of ropes **k** $(1 \le k \le n / 2)$. The following **n** rows contain one integer number representing the position of each toy $(0 <= x_i <= 10^9$ for all **i** from **1** to **n**). These numbers will be given in ascending order, that is, $x_i < x_{i+1}$. Neither of two toys occupies the same coordinate.

Output data:

The output file must contain one number, which characterizes the least total length of all ropes.

Input file example:

5 2

3

5

6

8

14

Output file example:

4

Explanation of the problem:

It is advantageous to connect the first toy with the second one with a length of 2, and to connect the third toy with a fourth rope which length is 2. In total we will receive 4 and this is the minimum possible answer.