Problem 1: Farmer John has no Large Brown Cow

Farmer John likes to collect as many different types of cows as possible. In fact, he has collected almost every conceivable type of cow, except for a few, written on a short list of N lines (1 <= N <= 100). The list looks like this:

Farmer John has no large brown noisy cow.
Farmer John has no small white silent cow.
Farmer John has no large spotted noisy cow.

Each item in the list describes a missing cow in terms of a short list of adjectives, and each item contains the same number of adjectives (3, in this case). The number of adjectives per line will be in the range 2..30.

Farmer John has a cow fitting every other possible adjective combination not on his list. In this example, the first adjective can be large or small, the second can be brown, white, or spotted, and the third can be noisy or silent. This gives 2 x 3 x 2 = 12 different combinations, and Farmer John has a cow fitting each one, except for those specifically mentioned on his list. In this example, a large, white, noisy cow is one of his 9 cows. Farmer John is certain that he has at most 1,000,000,000 cows.

If Farmer John lists his cows in alphabetical order, what is the Kth cow in this list?

Partial credit opportunities: In the 10 test cases for this problem, cases 1..4 involve at most two adjectives per line in Farmer John's list. In cases 1..6, each adjective will have exactly two possible settings (in all other cases, each adjective will have between 1 and N possible settings).

INPUT FORMAT:

* Line 1: Two integers, N and K.

* Lines 2..1+N: Each line is a sentence like "Farmer John has no large spotted noisy cow.". Each adjective in the sentence will be a string of at most 10 lowercase letters. You know you have reached the end of the sentence when you see the string "cow." ending with a period.

SAMPLE INPUT:

```
3 7
Farmer John has no large brown noisy cow.
Farmer John has no small white silent cow.
Farmer John has no large spotted noisy cow.
```

INPUT DETAILS:

The input matches the sample given in the problem statement above. Farmer John would like to know the 7th cow on his farm, when listed in alphabetical order.

OUTPUT FORMAT:

* Line 1: The description of the Kth cow on the farm.

SAMPLE OUTPUT:

```
small spotted noisy
```

OUTPUT DETAILS:

Farmer john has cows matching the following descriptions, listed in alphabetical order:

```
large brown silent
large spotted silent
large white noisy
large white silent
small brown noisy
small brown silent
small spotted noisy
small spotted silent
small white noisy
```

The 7th cow in this list is described as "small spotted noisy".

Problem 2: Crowded Cows [Brian Dean, 2013]

Farmer John's N cows (1 <= N <= 50,000) are grazing along a one-dimensional fence. Cow i is standing at location x(i) and has height h(i) (1 <= x(i),h(i) <= 1,000,000,000).

A cow feels "crowded" if there is another cow at least twice her height within distance D on her left, and also another cow at least twice her height within distance D on her right (1 <= D <= 1,000,000,000). Since crowded cows produce less milk, Farmer John would like to count the number of such cows. Please help him.

INPUT FORMAT:

* Line 1: Two integers, N and D.

* Lines 2..1+N: Line i+1 contains the integers x(i) and h(i). The locations of all N cows are distinct.

SAMPLE INPUT:

```
6 4
10 3
6 2
5 3
9 7
3 6
11 2
```

INPUT DETAILS:

There are 6 cows, with a distance threshold of 4 for feeling crowded. Cow #1 lives at position x=10 and has height h=3, and so on.

OUTPUT FORMAT:

* Line 1: The number of crowded cows.

SAMPLE OUTPUT:

```
2
```

OUTPUT DETAILS:

The cows at positions x=5 and x=6 are both crowded.

Problem 3: Pogo-Cow

In an ill-conceived attempt to enhance the mobility of his prize cow Bessie, Farmer John has attached a pogo stick to each of Bessie's legs. Bessie can now hop around quickly throughout the farm, but she has not yet learned how to slow down.

To help train Bessie to hop with greater control, Farmer John sets up a practice course for her along a straight one-dimensional path across his farm. At various distinct positions on the path, he places N targets on which Bessie should try to land (1 <= N <= 1000). Target i is located at position x(i), and is worth p(i) points if Bessie lands on it. Bessie starts at the location of any target of her choosing and is allowed to move in only one direction, hopping from target to target. Each hop must cover at least as much distance as the previous hop, and must land on a target.

Bessie receives credit for every target she touches (including the initial target on which she starts). Please compute the maximum number of points she can obtain.

INPUT FORMAT:

* Line 1: The integer N.

* Lines 2..1+N: Line i+1 contains x(i) and p(i), each an integer in
       the range 0..1,000,000.

SAMPLE INPUT:

```
6
5 6
1 1
10 5
7 6
4 8
8 10
```

INPUT DETAILS:

There are 6 targets. The first is at position x=5 and is worth 6 points, and so on.

OUTPUT FORMAT:

* Line 1: The maximum number of points Bessie can receive.

SAMPLE OUTPUT:

25

OUTPUT DETAILS:

Bessie hops from position x=4 (8 points) to position x=5 (6 points) to position x=7 (6 points) to position x=10 (5 points).

Problem 4: Line of Sight

Farmer John's N cows (1 <= N <= 50,000) are located at distinct points in his two-dimensional pasture. In the middle of the pasture is a large circular grain silo. Cows on opposite sides of the silo cannot see each-other, since the silo blocks their view. Please determine the number of pairs of cows that can see each-other via a direct line of sight.

The grain silo is centered at the origin (0,0) and has radius R. No cow is located on or inside the circle corresponding to the silo, and no two cows lie on a tangent line to the silo. The value of R is in the range 1..1,000,000, and each cow lives at a point with integer coordinates in the range -1,000,000..+1,000,000.

INPUT FORMAT:

* Line 1: Two integers: N and R.

* Lines 2..1+N: Each line contains two integers specifying the (x,y) coordinates of a cow.

SAMPLE INPUT:

```
4 5
0 10
0 -10
10 0
-10 0
```

INPUT DETAILS:

There are 4 cows at positions (0,10), (0,-10), (10,0), and (-10,0). The silo is centered at (0,0) and has radius 5.

OUTPUT FORMAT:

* Line 1: The number of pairs of cows who can see each-other.

SAMPLE OUTPUT:

```
4
```

OUTPUT DETAILS:

All 6 pairs of cows can see each-other, except for the pairs situated on opposite sides of the silo: the cows at (-10,0) and (10,0) cannot see each-other, and the cows at (0,-10) and (0,10) cannot see each-other.

Problem 5: No Change

Farmer John is at the market to purchase supplies for his farm. He has in his pocket K coins (1 <= K <= 16), each with value in the range 1..100,000,000. FJ would like to make a sequence of N purchases (1 <= N <= 100,000), where the ith purchase costs c(i) units of money (1 <= c(i) <= 10,000). As he makes this sequence of purchases, he can periodically stop and pay, with a single coin, for all the purchases made since his last payment (of course, the single coin he uses must be large enough to pay for all of these). Unfortunately, the vendors at the market are completely out of change, so whenever FJ uses a coin that is larger than the amount of money he owes, he sadly receives no changes in return!

Please compute the maximum amount of money FJ can end up with after making his N purchases in sequence. Output -1 if it is impossible for FJ to make all of his purchases.

INPUT FORMAT:

* Line 1: Two integers, K and N.

* Lines 2..1+K: Each line contains the amount of money of one of FJ's coins.

* Lines 2+K..1+N+K: These N lines contain the costs of FJ's intended purchases.

SAMPLE INPUT:

```
3 6
12
15
10
6
3
3
2
3
7
```

INPUT DETAILS:

FJ has 3 coins of values 12, 15, and 10. He must make purchases in sequence of value 6, 3, 3, 2, 3, and 7.

OUTPUT FORMAT:

* Line 1: The maximum amount of money FJ can end up with, or -1 if FJ
       cannot complete all of his purchases.

SAMPLE OUTPUT:

12

OUTPUT DETAILS:

FJ spends his 10-unit coin on the first two purchases, then the 15-unit coin on the remaining purchases. This leaves him with the 12-unit coin.