A. Dima and Staircase

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

Dima's got a staircase that consists of n stairs. The first stair is at height a_1, the second one is at a_2, the last one is at a_n $(1 \le a_1 \le a_2 \le \ldots \le a_n)$.

Dima decided to play with the staircase, so he is throwing rectangular boxes at the staircase from above. The i-th box has width w_i and height h_i. Dima throws each box vertically down on the first w_i stairs of the staircase, that is, the box covers stairs with numbers $1, 2, \ldots, w_i$. Each thrown box flies vertically down until at least one of the two following events happen:

- the bottom of the box touches the top of a stair;
- the bottom of the box touches the top of a box, thrown earlier.

We only consider touching of the horizontal sides of stairs and boxes, at that touching with the corners isn't taken into consideration. Specifically, that implies that a box with width w_i cannot touch the stair number $w_i + 1$.

You are given the description of the staircase and the sequence in which Dima threw the boxes at it. For each box, determine how high the bottom of the box after landing will be. Consider a box to fall after the previous one lands.

Input

The first line contains integer n $(1 \le n \le 10^5)$ — the number of stairs in the staircase. The second line contains a non-decreasing sequence, consisting of n integers, $a_1, a_2, \ldots, a_n$ $(1 \le a_i \le 10^9;\ a_i \le a_{i+1})$.

The next line contains integer m $(1 \le m \le 10^5)$ — the number of boxes. Each of the following m lines contains a pair of integers w_i, h_i $(1 \le w_i \le n;\ 1 \le h_i \le 10^9)$ — the size of the i-th thrown box.

The numbers in the lines are separated by spaces.

Output

Print m integers — for each box the height, where the bottom of the box will be after landing. Print the answers for the boxes in the order, in which the boxes are given in the input.

Please, do not use the `%lld` specifier to read or write 64-bit integers in C++. It is preferred to use the `cin`, `cout` streams or the `%I64d` specifier.

Examples

input

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

output

```
1
3
4
6
```

input

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

output

```
1
3
```

input

```
1
1
5
1 2
1 10
1 10
1 10
1 10
```

output

```
1
3
13
23
33
```

Note

The first sample are shown on the picture.

B. Dima and Two Sequences

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

Little Dima has two sequences of points with integer coordinates: sequence $(a_1, 1), (a_2, 2), \ldots, (a_n, n)$ and sequence $(b_1, 1), (b_2, 2), \ldots, (b_n, n)$.

Now Dima wants to count the number of distinct sequences of points of length $2 \cdot n$ that can be assembled from these sequences, such that the x-coordinates of points in the assembled sequence will **not decrease**. Help him with that. Note that each element of the initial sequences should be used exactly once in the assembled sequence.

Dima considers two assembled sequences $(p_1, q_1), (p_2, q_2), \ldots, (p_{2 \cdot n}, q_{2 \cdot n})$ and $(x_1, y_1), (x_2, y_2), \ldots, (x_{2 \cdot n}, y_{2 \cdot n})$ distinct, if there is such i $(1 \le i \le 2 \cdot n)$, that $(p_i, q_i) \ne (x_i, y_i)$.

As the answer can be rather large, print the remainder from dividing the answer by number m.

Input

The first line contains integer n $(1 \le n \le 10^5)$. The second line contains n integers $a_1, a_2, \ldots, a_n$ $(1 \le a_i \le 10^9)$. The third line contains n integers $b_1, b_2, \ldots, b_n$ $(1 \le b_i \le 10^9)$. The numbers in the lines are separated by spaces.

The last line contains integer m $(2 \le m \le 10^9 + 7)$.

Output

In the single line print the remainder after dividing the answer to the problem by number m.

Examples

input

```
1
1
2
7
```

output

```
1
```

input

```
2
1 2
2 3
11
```

output

```
2
```

Note

In the first sample you can get only one sequence: $(1, 1), (2, 1)$.

In the second sample you can get such sequences : $(1, 1), (2, 2), (2, 1), (3, 2)$; $(1, 1), (2, 1), (2, 2), (3, 2)$. Thus, the answer is 2.

C. Dima and Horses

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

Dima came to the horse land. There are n horses living in the land. Each horse in the horse land has several enemies (enmity is a symmetric relationship). The horse land isn't very hostile, so the number of enemies of each horse is at most 3.

Right now the horse land is going through an election campaign. So the horses trusted Dima to split them into two parts. At that the horses want the following condition to hold: a horse shouldn't have more than one enemy in its party.

Help Dima split the horses into parties. Note that one of the parties can turn out to be empty.

Input

The first line contains two integers n, m $(1 \le n \le 3 \cdot 10^5; 0 \le m \le \min(3 \cdot 10^5, \frac{n(n-1)}{2}))$ — the number of horses in the horse land and the number of enemy pairs.

Next m lines define the enemy pairs. The i-th line contains integers a_i, b_i $(1 \le a_i, b_i \le n;\ a_i \ne b_i)$, which mean that horse a_i is the enemy of horse b_i.

Consider the horses indexed in some way from 1 to n. It is guaranteed that each horse has at most three enemies. No pair of enemies occurs more than once in the input.

Output

Print a line, consisting of n characters: the i-th character of the line must equal "0", if the horse number i needs to go to the first party, otherwise this character should equal "1".

If there isn't a way to divide the horses as required, print -1.

Examples

input

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

output

```
100
```

input

```
2 1
2 1
```

output

```
00
```

input

```
10 6
1 2
1 3
1 4
2 3
2 4
3 4
```

output

```
0110000000
```

D. Dima and Figure

time limit per test: 3 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Dima loves making pictures on a piece of squared paper. And yet more than that Dima loves the pictures that depict one of his favorite figures.

A piece of squared paper of size $n \times m$ is represented by a table, consisting of n rows and m columns. All squares are white on blank squared paper. Dima defines a *picture* as an image on a blank piece of paper, obtained by painting some squares black.

The picture portrays one of Dima's favorite figures, if the following conditions hold:

- The picture contains at least one painted cell;
- All painted cells form a connected set, that is, you can get from any painted cell to any other one (you can move from one cell to a side-adjacent one);
- The minimum number of moves needed to go from the painted cell at coordinates (x_1, y_1) to the painted cell at coordinates (x_2, y_2), moving only through the colored cells, equals $|x_1 - x_2| + |y_1 - y_2|$.

Now Dima is wondering: how many paintings are on an $n \times m$ piece of paper, that depict one of his favorite figures? Count this number modulo 1000000007 $(10^9 + 7)$.

Input

The first line contains two integers n and m — the sizes of the piece of paper $(1 \le n, m \le 150)$.

Output

In a single line print the remainder after dividing the answer to the problem by number 1000000007 $(10^9 + 7)$.

Examples

input
```
2 2
```
output
```
13
```

input
```
3 4
```
output
```
571
```

E. Dima and Game

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

Dima and Anya love playing different games. Now Dima has imagined a new game that he wants to play with Anya.

Dima writes n pairs of integers on a piece of paper (l_i, r_i) $(1 \le l_i < r_i \le p)$. Then players take turns. On his turn the player can do the following actions:

1. choose the number of the pair i $(1 \le i \le n)$, such that $r_i - l_i > 2$;
2. replace pair number i by pair $(l_i + \lfloor \frac{r_i - l_i}{3} \rfloor, l_i + 2 \cdot \lfloor \frac{r_i - l_i}{3} \rfloor)$ or by pair $(l_i, r_i - \lfloor \frac{r_i - l_i}{3} \rfloor)$. Notation $\lfloor x \rfloor$ means rounding down to the closest integer.

The player who can't make a move loses.

Of course, Dima wants Anya, who will move first, to win. That's why Dima should write out such n pairs of integers (l_i, r_i) $(1 \le l_i < r_i \le p)$, that if both players play optimally well, the first one wins. Count the number of ways in which Dima can do it. Print the remainder after dividing the answer by number 1000000007 $(10^9 + 7)$.

Two ways are considered distinct, if the **ordered** sequences of the written pairs are distinct.

Input

The first line contains two integers n, p $(1 \le n \le 1000, 1 \le p \le 10^9)$. The numbers are separated by a single space.

Output

In a single line print the remainder after dividing the answer to the problem by number 1000000007 $(10^9 + 7)$.

Examples

input
```
2 2
```
output
```
0
```

input
```
4 4
```
output
```
520
```

input
```
100 1000
```
output
```
269568947
```

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