A. Replacement

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

Little Petya very much likes arrays consisting of n integers, where each of them is in the range from 1 to 10^9, inclusive. Recently he has received one such array as a gift from his mother. Petya didn't like it at once. He decided to choose exactly one element from the array and replace it with another integer that also lies in the range from 1 to 10^9, inclusive. It is **not allowed** to replace a number with itself or to change no number at all.

After the replacement Petya sorted the array by the numbers' non-decreasing. Now he wants to know for each position: what minimum number could occupy it after the replacement and the sorting.

Input

The first line contains a single integer n ($1 \le n \le 10^5$), which represents how many numbers the array has. The next line contains n space-separated integers — the array's description. All elements of the array lie in the range from 1 to 10^9, inclusive.

Output

Print n space-separated integers — the minimum possible values of each array element after one replacement and the sorting are performed.

Sample test(s)

input

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

output

```
1 1 2 3 4
```

input

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

output

```
1 2 3 4 5
```

input

```
3
2 2 2
```

output

```
1 2 2
```

B. Rectangle and Square

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

Little Petya very much likes rectangles and especially squares. Recently he has received 8 points on the plane as a gift from his mother. The points are pairwise distinct. Petya decided to split them into two sets each containing 4 points so that the points from the first set lay at the vertexes of some square and the points from the second set lay at the vertexes of a rectangle. Each point of initial 8 should belong to exactly one set. It is acceptable for a rectangle from the second set was also a square. If there are several partitions, Petya will be satisfied by any of them. Help him find such partition. Note that the rectangle and the square from the partition should have non-zero areas. The sides of the figures **do not have** to be parallel to the coordinate axes, though it might be the case.

Input

You are given 8 pairs of integers, a pair per line — the coordinates of the points Petya has. The absolute value of all coordinates does not exceed 10^4. It is guaranteed that no two points coincide.

Output

Print in the first output line "YES" (without the quotes), if the desired partition exists. In the second line output 4 space-separated numbers — point indexes from the input, which lie at the vertexes of the square. The points are numbered starting from 1. The numbers can be printed in any order. In the third line print the indexes of points lying at the vertexes of a rectangle in the similar format. All printed numbers should be pairwise distinct.

If the required partition does not exist, the first line should contain the word "NO" (without the quotes), after which no output is needed.

Sample test(s)

input

```
0 0
10 11
10 0
0 11
1 1
2 2
2 1
1 2
```

output

```
YES
5 6 7 8
1 2 3 4
```

input

```
0 0
1 1
2 2
3 3
4 4
5 5
6 6
7 7
```

output

```
NO
```

input

```
0 0
4 4
4 0
0 4
1 2
2 3
3 2
2 1
```

output

```
YES
1 2 3 4
5 6 7 8
```

Note

Pay attention to the third example: the figures do not necessarily have to be parallel to the coordinate axes.

C. Zero-One

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

Little Petya very much likes playing with little Masha. Recently he has received a game called "Zero-One" as a gift from his mother. Petya immediately offered Masha to play the game with him.

Before the very beginning of the game several cards are lain out on a table in one line from the left to the right. Each card contains a digit: 0 or 1. Players move in turns and Masha moves first. During each move a player should remove a card from the table and shift all other cards so as to close the gap left by the removed card. For example, if before somebody's move the cards on the table formed a sequence 01**010**101, then after the fourth card is removed (the cards are numbered starting from 1), the sequence will look like that: 01**00**101.

The game ends when exactly two cards are left on the table. The digits on these cards determine the number in binary notation: the most significant bit is located to the left. Masha's aim is to minimize the number and Petya's aim is to maximize it.

An unpleasant accident occurred before the game started. The kids spilled juice on some of the cards and the digits on the cards got blurred. Each one of the spoiled cards could have either 0 or 1 written on it. Consider all possible variants of initial arrangement of the digits (before the juice spilling). For each variant, let's find which two cards are left by the end of the game, assuming that both Petya and Masha play optimally. An ordered pair of digits written on those two cards is called an *outcome*. Your task is to find the set of outcomes for all variants of initial digits arrangement.

Input

The first line contains a sequence of characters each of which can either be a "0", a "1" or a "?". This sequence determines the initial arrangement of cards on the table from the left to the right. The characters "?" mean that the given card was spoiled before the game. The sequence's length ranges from 2 to 10^5, inclusive.

Output

Print the set of outcomes for all possible initial digits arrangements. Print each possible outcome on a single line. Each outcome should be represented by two characters: the digits written on the cards that were left by the end of the game. The outcomes should be sorted lexicographically in ascending order (see the first sample).

Sample test(s)

input
```
????
```
output
```
00
01
10
11
```

input
```
1010
```
output
```
10
```

input
```
1?1
```
output
```
01
11
```

Note

In the first sample all 16 variants of numbers arrangement are possible. For the variant 0000 the outcome is 00. For the variant 1111 the outcome is 11. For the variant 0011 the outcome is 01. For the variant 1100 the outcome is 10. Regardless of outcomes for all other variants the set which we are looking for will contain all 4 possible outcomes.

In the third sample only 2 variants of numbers arrangement are possible: 111 and 101. For the variant 111 the outcome is 11. For the variant 101 the outcome is 01, because on the first turn Masha can remove the first card from the left after which the game will end.

D. Cycle

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

Little Petya very much likes rectangular tables that consist of characters "0" and "1". Recently he has received one such table as a gift from his mother. The table contained n rows and m columns. The rows are numbered from top to bottom from 1 to n, the columns are numbered from the left to the right from 1 to m. Petya immediately decided to find the longest cool cycle whatever it takes.

A cycle is a sequence of pairwise distinct cells where each two consecutive cells have a common side; besides, the first cell has a common side with the last cell. A cycle is called cool if it fulfills all the following conditions simultaneously:

- The cycle entirely consists of the cells that contain "1".
- Each cell that belongs to the cycle, has a common side with exactly two other cells that belong to the cycle.
- Each cell of the table that contains "1" either belongs to the cycle or is positioned outside of it (see definition below).

To define the notion of "outside" formally, let's draw a cycle on a plane. Let each cell of the cycle (i, j) (i is the row number, j is the column number) correspond to the point (i, j) on the coordinate plane. Let a straight line segment join each pair of points that correspond to the cells belonging to the cycle and sharing a side. Thus, we will get a closed polyline that has no self-intersections and self-touches. The polyline divides the plane into two connected parts: the part of an infinite area and the part of a finite area. It is considered that cell (r, c) lies outside of the cycle if it does not belong to the cycle and the corresponding point on the plane with coordinates (r, c) lies in the part with the infinite area.

Help Petya to find the length of the longest cool cycle in the table. The cycle length is defined as the number of cells that belong to the cycle.

Input

The first line contains two integers n and m ($1 \le n, m \le 1000$) — the number of rows and columns in the table, respectively. Each of the following n lines contains m characters. Each character can be either "0" or "1".

Output

Print a single number — the length of the longest cool cycle in the table. If such cycles do not exist, print 0.

Sample test(s)

input

```
3 3
111
101
111
```

output

```
8
```

input

```
5 5
01010
10101
01010
10101
01010
```

output

```
0
```

input

```
7 7
1111111
1000101
1000101
1000101
1000111
1000001
1111111
```

output

```
24
```

input

```
5 5
11111
10001
10101
10001
11111
```

output

```
0
```

Note

In the first example there's only one cycle and it is cool.

In the second sample there's no cycle at all.

In the third sample there are two cool cycles: their lengths are 12 and 24.

In the fourth sample there also is only one cycle but it isn't cool as there's a cell containing "1" inside this cycle.

E. Weak Subsequence

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

Little Petya very much likes strings. Recently he has received a voucher to purchase a string as a gift from his mother. The string can be bought in the local shop. One can consider that the shop has all sorts of strings over the alphabet of fixed size. The size of the alphabet is equal to k. However, the voucher has a string type limitation: specifically, the voucher can be used to purchase string s if the length of string's longest substring that is also its weak subsequence (see the definition given below) equals w.

String a with the length of n is considered the weak subsequence of the string s with the length of m, if there exists such a set of indexes $1 \le i_1 < i_2 < ... < i_n \le m$, that has the following two properties:

- $a_k = s_{i_k}$ for all k from 1 to n;
- there exists at least one such k $(1 \le k < n)$, for which $i_{k+1} - i_k > 1$.

Petya got interested how many different strings are available for him to purchase in the shop. As the number of strings can be very large, please find it modulo 1000000007 $(10^9 + 7)$. If there are infinitely many such strings, print "-1".

Input

The first line contains two integers k $(1 \le k \le 10^6)$ and w $(2 \le w \le 10^9)$ — the alphabet size and the required length of the maximum substring that also is the weak subsequence, correspondingly.

Output

Print a single number — the number of strings Petya can buy using the voucher, modulo 1000000007 $(10^9 + 7)$. If there are infinitely many such strings, print "-1" (without the quotes).

Sample test(s)

input
```
2 2
```
output
```
10
```

input
```
3 5
```
output
```
1593
```

input
```
2 139
```
output
```
717248223
```

Note

In the first sample Petya can buy the following strings: aaa, aab, abab, abb, abba, baa, baab, baba, bba, bbb.