DATA STRUCTURES AND ALGORITHMS

ASSIGNMENT-1
Language allowed: C

January 9, 2020

A. Sub-matrices and Dinner Plans

While cleaning his room, Rohan found two matrices P and Q that he had written down long ago. He now wants to know if Q is a *sub-matrix* of P. As he has dinner plans with his friends tonight, he asked you to solve the problem for him. A *sub-matrix* is defined in the following way:
Matrix B is said to be a sub-matrix of Matrix A if you can find B *embedded contiguously* in A. (see sample cases for clarity).

Input

The first line of input contains two space-separated integers N, M ($1 \leq N, M \leq 100$) denoting the dimensions of matrix P. The following N lines contain M space-separated integers each ($0 \leq P_{ij} \leq 10^9$) denoting the matrix P. The next line contains two space-separated integers X, Y ($1 \leq X, Y \leq 100$) denoting the dimensions of matrix Q. The following X lines contain Y space-separated integers each($0 \leq Q_{ij} \leq 10^9$) denoting the matrix Q. *Indexing of the matrices start from (0, 0).*

Output

Print "YES", followed by the indices of the starting element of Q in P in the next line if Q is a *sub-matrix* of P, else print "NO". If there are multiple answers, print any.

```
input
4 4
1 7 0 0
2 7 1 99
56 7 1 2
0 0 2 5
2 2
7 1
7 1

output
YES
1 1
```

```
input
3 3
1 1 3
1 4 5
8 9 1
1 2
1 5

output
NO
```

B. Koro-sensei and Primes

Koro-sensei has come up with a quite an eerie problem on primes for the students of class 3E. Given two numbers A and B, the students have to find the digit which occurs maximum number of times in the primes *from A to B (both inclusive)*. As the class is busy getting ready for the annual school festival, they all turn to you, Karuma for help.

Input

The only line of input contains two space-separated A and B ($2 \leq A \leq B \leq 10^{12},\ 0 \leq |B-A| \leq 10^6$).

Output

Print two space-separated integers X, Y with X denoting the digit which occurs maximum number of time in the primes from A to B (both inclusive) and Y denoting the frequency of X.

---

input
37 101

output
7 7

---

input
2692 15859

output
1 1367

C. Where's the string?

Sheldon has once again come up with a new game to test his friends. He gives them a sentence with many words and asks them to find the *minimum window* in that sentence that contains all the letters given in another word which he gives. As Leonard recently broke his glasses, he asks you, Howard, to step in for him and play Sheldon's game.
Note that the minimum window substring can contain a few other letters other than the letters in the given word, but strictly contains all the letters of the given word and has minimum substring length among all such windows.

Input

The first line contains a single string S ($1 \leq |S| \leq 10^6$) denoting the sentence Sheldon gives his friends. S is considered to be 0-indexed. The next line contains the word W ($1 \leq |W| \leq 10^6$) whose letters have to be found.

Output

If a *minimum window* exists, print the starting and ending indices of the window (both ends inclusive). In the following line, print the subtring itself. If there are multiple correct answers, print any. If no such window exists, print "NO WINDOW".

```
input
this is a test string for the problem
tist

output
13 18
t stri
```

D. No repetitions - I

You received a long string as your birthday gift. Out of curiosity, you plan to find the longest substring in that given string which has no repeating characters.

Input

The only line contains a single string S ($1 \leq |S| \leq 10^6$) which you received as your gift.

Output

In the first line print the length of the longest substring with no repeating characters and in the next line print the substring itself. If there are multiple answers, print any.

---

input
vkaaienfasoianavafhadbll

output
7
ienfaso

---

input
ddddddddddddd

output
1
d

E. Reverse it!

Given a sentence string S, your task is to print all the words in the string in reverse order and hence, find all the palindromic words in the sentence. *The words in the string are space separated.*

Input

The only line contains a single string S ($1 \leq |S| \leq 10^6$).

Output

In the first line print the sentence with all its words *reversed* (see sample case for clarity) and in the following lines print all the palindromic words in the given sentence. The palindromic words can be printed in any order. If there are no palindromic words in the sentence, print "NO PALINDROMES".

```
input
the kayak could not be detected on the radar

output
eht kayak dluoc ton eb detceted no eht radar
kayak
radar
```

F. Half Adder

A *bit linked list* is a special type of singly linked list, which holds a bit string with each *Node* having exactly one bit (0 or 1). Your task for this problem is to implement a *half adder* using two bit linked lists, i.e. to add two bit linked lists. Constraints for this problem:
a. Arrays should not be used to solve this problem, only singly linked lists must be used.
b. You should not store the given two binary numbers as integers anywhere in the program. The binary numbers given as input can be read as strings, but no further manipulations can be done on them. Direct use of + operator to solve this problem must not be made.
c. The final result of the addition should be contained in a bit linked list as well.
d. A single variable for *carry* can be used.

Input

The first line contains a single binary string B_1 ($1 \leq |B_1| \leq 10^6$) representing the first number X (addend). The last line of input contains the binary string B_2 ($1 \leq |B_2| \leq 10^6$) representing the second number Y (augend).

Output

Print the sum of the given two binary numbers in binary format

---

input
0111011010
10110

output
0111110000

---

input
111111111111
1

output
1000000000000

G. No repetitions - II

Given a *sorted* singly linked list of integers, your task is to remove all duplicates from the linked list. No use of arrays to store the integers must be made to solve this problem.

Input

The only line of input contains a sorted sequence of integers A ($-10^9 \leq A_i \leq 10^9$). The number of integers in the sequence will be less than 10^5.

Output

In the first line, print the length of the linked list after all duplicates are removed and in the following line print the linked list element-wise.

```
input
-11 -11 -10 6 6 7 7 7 9 9 9 9 9 10 12 12 16 16 87 87 87

output
9
-11 -10 6 7 9 10 12 16 87
```

```
input
1 2 3 4 5 6 7 8 9 10 11

output
11
1 2 3 4 5 6 7 8 9 10 11
```
