A. Train and Peter

time limit per test: 1 second
memory limit per test: 64 megabytes
input: standard input
output: standard output

Peter likes to travel by train. He likes it so much that on the train he falls asleep.

Once in summer Peter was going by train from city A to city B, and as usual, was sleeping. Then he woke up, started to look through the window and noticed that every railway station has a flag of a particular colour.

The boy started to memorize the order of the flags' colours that he had seen. But soon he fell asleep again. Unfortunately, he didn't sleep long, he woke up and went on memorizing the colours. Then he fell asleep again, and that time he slept till the end of the journey.

At the station he told his parents about what he was doing, and wrote two sequences of the colours that he had seen before and after his sleep, respectively.

Peter's parents know that their son likes to fantasize. They give you the list of the flags' colours at the stations that the train passes sequentially on the way from A to B, and ask you to find out if Peter could see those sequences on the way from A to B, or from B to A. Remember, please, that Peter had two periods of wakefulness.

Peter's parents put lowercase Latin letters for colours. The same letter stands for the same colour, different letters — for different colours.

Input

The input data contains three lines. The first line contains a non-empty string, whose length does not exceed 10^5, the string consists of lowercase Latin letters — the flags' colours at the stations on the way from A to B. On the way from B to A the train passes the same stations, but in reverse order.

The second line contains the sequence, written by Peter during the first period of wakefulness. The third line contains the sequence, written during the second period of wakefulness. Both sequences are non-empty, consist of lowercase Latin letters, and the length of each does not exceed 100 letters. Each of the sequences is written in chronological order.

Output

Output one of the four words without inverted commas:

- «`forward`» — if Peter could see such sequences only on the way from A to B;
- «`backward`» — if Peter could see such sequences on the way from B to A;
- «`both`» — if Peter could see such sequences both on the way from A to B, and on the way from B to A;
- «`fantasy`» — if Peter could not see such sequences.

Examples

input
atob a b
output
forward

input
aaacaaa aca aa
output
both

Note

It is assumed that the train moves all the time, so one flag cannot be seen twice. There are no flags at stations A and B.

B. Obsession with Robots

time limit per test: 2 seconds
memory limit per test: 64 megabytes
input: standard input
output: standard output

The whole world got obsessed with robots,and to keep pace with the progress, great Berland's programmer Draude decided to build his own robot. He was working hard at the robot. He taught it to walk the shortest path from one point to another, to record all its movements, but like in many Draude's programs, there was a bug — the robot didn't always walk the shortest path. Fortunately, the robot recorded its own movements correctly. Now Draude wants to find out when his robot functions wrong. Heh, if Draude only remembered the map of the field, where he tested the robot, he would easily say if the robot walked in the right direction or not. But the field map was lost never to be found, that's why he asks you to find out if there exist at least one map, where the path recorded by the robot is the shortest.

The map is an infinite checkered field, where each square is either empty, or contains an obstruction. It is also known that the robot never tries to run into the obstruction. By the recorded robot's movements find out if there exist at least one such map, that it is possible to choose for the robot a starting square (the starting square should be empty) such that when the robot moves from this square its movements coincide with the recorded ones (the robot doesn't run into anything, moving along empty squares only), and the path from the starting square to the end one is the shortest.

In one movement the robot can move into the square (providing there are no obstrutions in this square) that has common sides with the square the robot is currently in.

Input

The first line of the input file contains the recording of the robot's movements. This recording is a non-empty string, consisting of uppercase Latin letters `L`, `R`, `U` and `D`, standing for movements left, right, up and down respectively. The length of the string does not exceed `100`.

Output

In the first line output the only word `OK` (if the above described map exists), or `BUG` (if such a map does not exist).

Examples

input
LLUUUR
output
OK

input
RRUULLDD
output
BUG

C. Looking for Order

time limit per test: 4 seconds
memory limit per test: 512 megabytes
input: standard input
output: standard output

Girl Lena likes it when everything is in order, and looks for order everywhere. Once she was getting ready for the University and noticed that the room was in a mess — all the objects from her handbag were thrown about the room. Of course, she wanted to put them back into her handbag. The problem is that the girl cannot carry more than two objects at a time, and cannot move the handbag. Also, if he has taken an object, she cannot put it anywhere except her handbag — her inherent sense of order does not let her do so.

You are given the coordinates of the handbag and the coordinates of the objects in some Cartesian coordinate system. It is known that the girl covers the distance between any two objects in the time equal to the squared length of the segment between the points of the objects. It is also known that initially the coordinates of the girl and the handbag are the same. You are asked to find such an order of actions, that the girl can put all the objects back into her handbag in a minimum time period.

Input

The first line of the input file contains the handbag's coordinates x_s, y_s. The second line contains number n ($1 \le n \le 24$) — the amount of objects the girl has. The following n lines contain the objects' coordinates. All the coordinates do not exceed 100 in absolute value. All the given positions are different. All the numbers are integer.

Output

In the first line output the only number — the minimum time the girl needs to put the objects into her handbag.

In the second line output the possible optimum way for Lena. Each object in the input is described by its index number (from 1 to n), the handbag's point is described by number 0. The path should start and end in the handbag's point. If there are several optimal paths, print any of them.

Examples

input
0 0 2 1 1 -1 1
output
8 0 1 2 0

input
1 1 3 4 3 3 4 0 0
output
32 0 1 2 0 3 0

D. Two Friends

time limit per test: 1 second
memory limit per test: 64 megabytes
input: standard input
output: standard output

Two neighbours, Alan and Bob, live in the city, where there are three buildings only: a cinema, a shop and the house, where they live. The rest is a big asphalt square.

Once they went to the cinema, and the film impressed them so deeply, that when they left the cinema, they did not want to stop discussing it.

Bob wants to get home, but Alan has to go to the shop first, and only then go home. So, they agreed to cover some distance together discussing the film (their common path might pass through the shop, or they might walk circles around the cinema together), and then to part each other's company and go each his own way. After they part, they will start thinking about their daily pursuits; and even if they meet again, they won't be able to go on with the discussion. Thus, Bob's path will be a continuous curve, having the cinema and the house as its ends. Alan's path — a continuous curve, going through the shop, and having the cinema and the house as its ends.

The film ended late, that's why the whole distance covered by Alan should not differ from the shortest one by more than t_1, and the distance covered by Bob should not differ from the shortest one by more than t_2.

Find the maximum distance that Alan and Bob will cover together, discussing the film.

Input

The first line contains two integers: t_1, t_2 ($0 \le t_1, t_2 \le 100$). The second line contains the cinema's coordinates, the third one — the house's, and the last line — the shop's.

All the coordinates are given in meters, are integer, and do not exceed 100 in absolute magnitude. No two given places are in the same building.

Output

In the only line output one number — the maximum distance that Alan and Bob will cover together, discussing the film. Output the answer accurate to not less than 4 decimal places.

Examples

input
0 2 0 0 4 0 -3 0
output
1.0000000000

input
0 0 0 0 2 0 1 0
output
2.0000000000

E. Beads

time limit per test: 5 seconds
memory limit per test: 64 megabytes
input: standard input
output: standard output

One Martian boy called Zorg wants to present a string of beads to his friend from the Earth — Masha. He knows that Masha likes two colours: blue and red, — and right in the shop where he has come, there is a variety of adornments with beads of these two colours. All the strings of beads have a small fastener, and if one unfastens it, one might notice that all the strings of beads in the shop are of the same length. Because of the peculiarities of the Martian eyesight, if Zorg sees one blue-and-red string of beads first, and then the other with red beads instead of blue ones, and blue — instead of red, he regards these two strings of beads as identical. In other words, Zorg regards as identical not only those strings of beads that can be derived from each other by the string turnover, but as well those that can be derived from each other by a mutual replacement of colours and/or by the string turnover.

It is known that all Martians are very orderly, and if a Martian sees some amount of objects, he tries to put them in good order. Zorg thinks that a red bead is smaller than a blue one. Let's put 0 for a red bead, and 1 — for a blue one. From two strings the Martian puts earlier the string with a red bead in the i-th position, providing that the second string has a blue bead in the i-th position, and the first two beads $i - 1$ are identical.

At first Zorg unfastens all the strings of beads, and puts them into small heaps so, that in each heap strings are identical, in his opinion. Then he sorts out the heaps and chooses the minimum string in each heap, in his opinion. He gives the unnecessary strings back to the shop assistant and says he doesn't need them any more. Then Zorg sorts out the remaining strings of beads and buys the string with index k.

All these manupulations will take Zorg a lot of time, that's why he asks you to help and find the string of beads for Masha.

Input

The input file contains two integers n and k ($2 \le n \le 50; 1 \le k \le 10^{16}$) —the length of a string of beads, and the index of the string, chosen by Zorg.

Output

Output the k-th string of beads, putting 0 for a red bead, and 1 — for a blue one. If it s impossible to find the required string, output the only number -1.

Examples

input
4 4
output
0101

Note

Let's consider the example of strings of length 4 — 0001, 0010, 0011, 0100, 0101, 0110, 0111, 1000, 1001, 1010, 1011, 1100, 1101, 1110. Zorg will divide them into heaps: {0001, 0111, 1000, 1110}, {0010, 0100, 1011, 1101}, {0011, 1100}, {0101, 1010}, {0110, 1001}. Then he will choose the minimum strings of beads in each heap: 0001, 0010, 0011, 0101, 0110. The forth string — 0101.