Problem A. Arithmetics Game

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	1024 mebibytes

This is an interactive problem

At the beginning of the game, $2n$ consecutive integers are written on board. Alice and Bob make their moves in a turn with Alice starting first. The move consists of erasing one of integers that still are on board. After $2n-2$ turns, there will remain only two integers. If their GCD is not equal to 1, then Alice wins, otherwise Bob wins.

Bob wants to beat Alice in this game, and asks you to help him with the program that can play for him.

Interaction Protocol

At the beginning, the jury program tells you one integer n ($1 \le n \le 10^5$), that defines the size of array.

Initially, at the board are $2n$ integers.

Then $n-1$ times the following two actions happen: the jury program prints one integer between 1 and $2n$ — the integer that is erased by Alice, and your program shall answer with some non-erased integer that is erased by Bob. Attempt to erase already erased integer immediately causes Wrong Answer error.

If the greater common divisor of the remaining two integers is 1, you win. Otherwise you lose and recieve Wrong Answer.

Examples

standard input	standard output
2 4	2
5 5 9 3 8	6 4 2 1

Note

Do not forget to end each your turn with end-of-line character and to flush the buffer after it.

Problem B. Broken Connection

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	1024 mebibytes

This is the problem with double run

Alice shall tell to Bob non-negative integer X, that is strictly less than 10^{10}. But the internet channel between them is broken, so the digits in the number that is sent by Alice are randomly shuffled.

Alice can send arbitrary non-negative integer consisting of no more than 50 digits (the leading zeroes are allowed).

Bob receives the Alice's integer after the string representing this integer was shuffled. His task is to determint X using that information.

Input

The first line of the input contains one string — "`Alice`", if the data is for Alice, and "`Bob`", if the data is for Bob.

In case when the input is for Alice, the second line contains the secret integer X ($0 \le X < 10^{10}$), given without extra leading zeroes.

In case when the input is for Bob, the second line contains a string s consisting of the digits — the integer sent by Alice with the shuffled digits. The string s cannot be empty or contain more than 50 digits.

Output

When processing the input for Alice, print non-empty digital string, consisting of no more than 50 digits.

When processing the input for Bob, print one integer — the value of the secret integer X.

Example

standard input	standard output
Alice 2022	01102022
Bob 20221011	2022

Note

Your solution will be run twice — the first time on the data for Alice, and the second time on the data for Bob.

Problem C. Contemporary Artist

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	1024 mebibytes

Given a tree with N vertices. The famous artist Kalevich wants to make art object from it and paint its vertices. Kalevich plans to use K colors and every vertex should be painted in one color. Moreover, the Kalevich plans paint tree in a way that the distance between 2 nearest vertices with same color is maximal possible.

You should find this maximal distance and the number of such paintings modulo 998 244 353. Two paintings are considered different if there exist at least one vertex which has different colors.

Input

First line of the input contains 2 integers N ($2 \le N \le 2000$) and K ($1 \le K < N$). Each of the next $N - 1$ lines contains 2 integers a_i, b_i, which means that vertices a_i and b_i are connected by an edge ($1 \le a_i, b_i \le N$).

Output

Print 2 integers – maximal distance between nearest vertices with same color and number of such paintings modulo 998 244 353.

Example

standard input	standard output
4 2 1 2 1 3 1 4	2 2

Problem D. Delete And Win

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	1024 mebibytes

You are given two strings composed of lowercase English letters.

One is the sample, and you can't change it. Your task is to make other string lexicographically smaller than the sample. In order to achieve the goal you can delete some characters. Your task is to find the minimum number of characters you have to delete in order to achieve the goal.

A string s is considered to be lexicographically smaller than a string t if s is a prefix of t (but is not equal to t) or the string s contains smaller character (in terms of English alphabet) than the string t in the first position they differ.

Input

The two lines of the input contain two strings of lowercase English letters. The first one is the string you may change while the second one is the sample. Both strings contain at least 1 and at most 10^5 characters.

Output

In the only line of the output print a single integer — the answer for the problem.

Example

standard input	standard output
pqsrpspqz pqrpqz	2

Problem E. Eggs Repainting

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	1024 mebibytes

There are N eggs placed in a row and numbered from 1 to N from the left to the right.

Also, there are N distinct colors. Initially, the i-th egg is colored in the i-th color.

Then Byteazar performs the following process K times: take a random egg and repaint it in a random color. After the process is done, Zenyk wants to know the number of colors for which there is at least one egg colored in it.

So he wants to find this values for all N^{2K} ways (N choices of a egg and N choices of a color) and count their sum. As this number can be very huge output it modulo 998 244 353.

Input

One line contains 2 integers N and K ($1 \le N, K \le 2000$).

Output

Print one integer – value Byteazar wants to find modulo 998 244 353.

Example

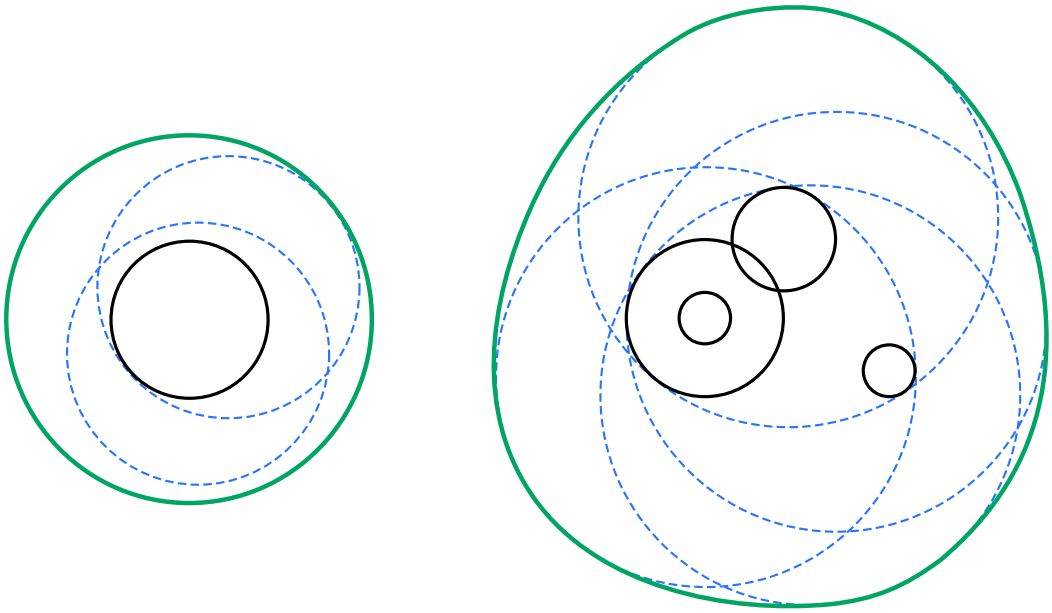
standard input	standard output
4 3	11656

Problem F. Find The Length

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	1024 mebibytes

Given n black circles on the plane. Alice plans to draw a blue circle of radius R such as no part of black circle is outside that circle. But before Bob plans to draw a green closed curve such as for any possible position of the blue circle there will be no part of the blue circle outside the green curve.

Your task is to find the minimal length of the green curve. Note that the black circles may touch the blue circle or even the green curve, and the blue circle may touch the green curve.



Input

The first line of the input contains two integers N ($1 \le N \le 100$) and R ($1 \le R \le 1000$) — the number of the black circles and the radius of the blue circle, respectively.

Each of the following N lines contains three space-separated integers x_i, y_i and r_i. First two of those integers are the coordinates of the center of i-th black circle ($-500 \le x_i, y_i \le 500$). Third integer is the radius of that circle ($1 \le r_i < \min\{R, 500\}$). No two black circles coincide.

You may assume that if we will change R by no more than 10^{-7}, then answer changes no more than by 10^{-3}.

Output

If it is impossible to draw the blue circle, print "`Impossible`". Otherwise print one real number — the minimal possible length of the green curve, with absolute or relative error 10^{-4} or better.

Examples

standard input	standard output
1 5 0 0 3	43.982297150257
4 8 -1 -1 3 -1 -1 1 6 -3 1 2 2 2	69.138911696387
2 10 -8 1 3 8 2 4	Impossible

Note

At the pictures, there are samples 1 and 2. The possible places fot the blue circle are denoted by the dotted line.

Problem G. Genetic Modifications

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	1024 mebibytes

DNA of viruses in the galaxy far far away consists of two elements: 'A' and 'B', so it can be represented as the string consisting of letters 'A' and 'B'.

The scientists have two viruses: source virus s and target virus t. They are trying to cut out exactly $|t|$ characters from s in such a way that the following two conditions are fulfilled:

1. The cut out elements make up string t, if placed in the same order as in s.
2. The remaining parts of s must be of form "AA..A" or "BB..B". In other words, there should be no part that contains both 'A' and 'B' at the same time.

Check if the experiment is possible, and if it is possible, help the scientists to achieve their goal.

Input

The first line of the input contains string s, and the second line contains string t ($1 \le |t| \le |s| \le 10^5$). Both strings consist only of 'A' and 'B' characters.

Output

On the first line print "YES" if it is possible to achieve the goal, and "NO" otherwise (without quotes). In case of a positive answer, on the next line print $|t|$ distinct integers in increasing order, which are the positions of characters that shall be cut out from s (1-based index). If multiple answers exist, you may print any one of them.

Examples

standard input	standard output
BBAAABBAAABAAA BAAB	YES 2 5 8 11
ABABABABAB ABAB	NO

Note

In the first sample, after cutting out the given characters, the following parts are left out: "B", "AA", "BB", "AA", "AAA". None of them contain both 'A' and 'B' at the same time.

Problem H. How To Identify Self

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	1024 mebibytes

This is an interactive problem.

...In tonight's nightmare you talked with a wizard... one bad joke, and found self at the chessboard as some white piece. You can see that you are placed on e2, but you cannot see, who you are — the Pawn, the Rook, the Knight, the Bishop, the Queen or the King. You can't ask the other pieces, because you are alone on the board.

You decided to choose a cell and try to move to this cell. If this move is legal for your piece, you are moving to this cell, otherwise you stay where you are. You are planning to do no more than 4 attempts to determine your piece and then **return to the same field e2** — else the angry wizard can turn you into something worse than chess piece...

Note that the white chess pieces are moving in the following way:

- Pawn — one cell forward (i.e. keep the column and increment the row by 1.
- Rook — at arbitrary number of cells at same row or same column.
- Bishop — diagonally on all four diagonal directions.
- Knight — moving two cells at one direction and one cell in the any of two orthogonal directions, in L-shape.
- Queen — at arbitrary number of cells in same row, column or diagonal directions.
- King — at any of 8 cells that share a common point with the current.

More complicated chess rules related to the pawns (like double first move or transformation to other piece after reaching cell at topmost row) are `not applied` here.

The cells are denoted by the 2-character strings: the first character — the letter between '`a`' and '`h`', inclusively — denote the column, the second character — the digit between '`1`' and '`8`', inclusively — denote the row.

Interaction Protocol

The interaction is started by your program, printing the attempt in the format `?` *target*, where the *target* is the cell in the chess notation. If you succeed, you receive the integer 1 (and now are on cell *target*), if you failed, you receive 0 and did not move anywhere.

If you want to print the answer, print '`!` c', where c is the lowercase English character denoting the piece: '`p`' for the Pawn, '`r`' for the Rook, '`b`' for the Bishop, '`n`' for the Knight, '`q`' for the Queen and '`k`' for the King. You may do that exactly once; ensure that you are on the cell e2 when you are printing the answer. This action **does not** counted as the query. If you printed the answer and you are not on e2 — the solution is considered wrong.

Example

standard input	standard output
0 1 0 1 1	? g3 ? e3 ? d2 ? e5 ? e2 ! r

Note

The interaction in the sample is just to clarify the output format: 5 attempts are **too much** for the correct solution.

Problem I. Independent Rectangles

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3 seconds
Memory limit:	1024 mebibytes

There are N rectangles with sides parallel to the axes on the plane. Please note that the rectangles might intersect.

Find the number of ways to choose two rectangles in a way that the following two conditions must be fulfilled:

- The two rectangles must have non-zero area of intersection.
- There should be no other rectangle with non-zero area of intersection with any of the two rectangles.

Input

The first line contains a single integers N ($2 \le N \le 10^5$) — the number of rectangles. The following N lines describe rectangles, one rectangle per line. The description consists of four integers x_1 y_1 x_2 y_2 ($0 \le x_1 < x_2 \le 10^6$, $0 \le y_1 < y_2 \le 10^6$) — the coordinates of lower-left and upper-right corners of the rectangle.

Output

Print a single integer — the number of ways to choose two rectangles.

Example

standard input	standard output
3 0 0 3 3 2 2 4 4 5 8 8 12	1

Problem J. Jumbosort

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	1024 mebibytes

They are given N stones placed in a row. All stones have distinct integer weights between 1 and N, inclusive. The challenge is to arrange these stones from the lightest to the heaviest.

The elephant Jumbo in one operation can pull out any subset of stones from the row and put them back at the beginning of the row without changing their relative order.

For example, consider 5 stones in a row with weights $[3, 1, 5, 4, 2]$. If Jumbo selects the second and the fifth stones, he can transform our row to $[1, 2, 3, 5, 4]$ in one operation.

Find the minimum number of operations Jumbo needs to sort the given row of stones by weight and also print one of the possible ways of optimal sorting.

Input

The first line of the input contains the single integer N ($1 \le N \le 10^5$). The second line contains N integers where i-th integer is the i-th stone weight. All weights are distinct integers between 1 and N, inclusive.

Output

The first line should contain the integer M — the minimum number of operations. The following $M + 1$ lines should contain N numbers each: the first one represents the initial row and all others represent a row after the corresponding operation.

Examples

standard input	standard output
5 3 1 5 4 2	2 3 1 5 4 2 1 5 2 3 4 1 2 3 4 5
4 2 1 3 4	1 2 1 3 4 1 2 3 4

Problem K. Knights of Light and Darkness

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	1024 mebibytes

This is an interactive problem

There are N knights on the island. Each knight at any moment of time is either Knight of Light or Knight of Darkness. Knights of Light answer truth on any question, while Knights of Darkness lie on any question, i.e. answer "Yes" instead "No" and "No" instead of "Yes".

When **any** knight answers "Yes", he **changes** his align immediately after the answer, i.e. the Knight of Light become the Knight of Darkness and the Knight of Darkness become the Knight of Light.

You are sent to the island with the important secret mission: tell the number of Knights of Light at the moment of your **departure** from the island.

To get the information, you may ask any person about any **other** person (the knights are enumerated by the sequential integers between 1 and N) in the form "Is knight Y the Knight of Light?" or "Is knight Y the Knight of Darkness?". You cannot ask the knight about himself, because it will look too suspiciously.

Can you finish this task for the finite number of questions? If yes, ask the **minimal possible** number of questions and then tell current number of the Knights of Light.

Note that the jury have the proof that for any position where the solution exists defined some optimal number of questions to solve this task.

Interaction Protocol

At the beginning of the interaction, you receive one integer N ($1 \le N \le 1000$) — the number of the knights on the island.

Then you may ask the questions.

If you want to ask the knight X, is the knight Y the Knight of Light, use the query in form "`? L` X Y".

If you want to ask the knight X, is the knight Y the Knight of Darkness, use the query in form "`? D` X Y". X and Y are the integers between 1 and N.

The answer will be 1 for "Yes" and 0 for "No".

If you after several questions (or immediately) decided that it was impossible to perform your mission, print the message "`!` -1" and exit.

If you in some moment decided that you know the current number of the Knights of Light, print the message "`!` N_l", where N_l is the current number of Knights of Light, and exit.

Note that interactor is **adaptive**, i.e. it may generate the initial distribution accordingly with your questions.

In case when you decide that the mission is impossible, you can ask no more than $4N/3$ questions before you do that. If you are going to tell the answer, you shall ask the **mininal possible** number of the questions.

Example

standard input	standard output
3 0 1 0	 ? L 1 2 ? D 1 2 ? D 3 1 ! 0

Note

Do not forget to print end-of-line after last integer in each query or in the final answer, and flush the output buffer after each query/final answer. Otherwise your solution may have the WTL error.

Note that the sample interaction in the statement is **only for the illustration of format** — the person who asked questions may have no reasons to answer and he is succeed (if he is) only on the blind luck.

Problem L. Lots Of Tasks

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	1024 mebibytes

Bytica is top manager in big Byteotian company, so she has a lot of tasks to do.

There are n tasks she has to do, and the i-th task is going to take time range from l_i to r_i, inclusive. Note that $r_i - l_i$ is an even number, and that the ranges can intersect in any way.

Bytica decided to makes work easier — for each task, she will choose either the first half of the existing time range or the second. But she does not like to change her life so much, so for each moment of time that she was busy before the halving, she wants to be must be busy after it as well.

Bytica is considered busy at some point of time if she has at least one task to do.

You task is to find out whether Bytica is able make her life easier or not.

Input

The first line contains a single integer n ($1 \le n \le 200$) — the number of tasks. The next n lines describe each time range $[l_i, r_i]$ ($0 \le l_i < r_i \le 10^9$, $r_i - l_i$ is even), which are always integer.

Output

In a single line print "YES" if the answer is positive, or "NO" otherwise.

Examples

standard input	standard output
4 1 9 5 13 11 13 6 12	YES
3 46 76 0 2 45 75	NO

Problem M. Multiple Communications

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	1024 mebibytes

This is problem with triple run

Given 200 **1000-bit** non-negative integers $a_1, \ldots, a_{100}$ and $b_1, \ldots, b_{100}$.

Alice gets the integers a_i only and can send the 3000-bit message X for Clara.

Bob gets the integers b_i only and can send the 3000-bit message Y for Clara.

Clara received both messages X and Y and shall answer 100 queries.

i-th query consists of non-negative integer c_i, and Clara shall tell the integers x_i and y_i, both between 1 and 100, such that the bitwise XOR of a_{x_i} and b_{y_i} is equal to c_i.

If she will answer 96 or more questions correctly, then the problem is considered as solved.

Input

The first line of the input contains the word "`Alice`", is this is input for Alice, "`Bob`", if this is the input for Bob, and "`Clara` if this is input for Clara.

If it is the input for Alice or Bob, each of 100 following lines contains exactly 1000 characters '`0`' and '`1`'; i-th of those lines represent a_i (for Alice) and b_i (for Bob).

If it is the input for Clara, the second line contains exactly 3000 characters '`0`' and '`1`' — the message from Alice. The third line contains exactly 3000 characters '`0`' and '`1`' — the message from Bob. Each of the 100 following lines contains exactly 1000 characters '`0`' and '`1`'; i-th of those lines replresent the query c_i.

Output

When working for Alice and for Bob, your program shall print one string of length exactly 3000, consisting of the characters '`0`' and '`1`' — the message for Clara.

When working for Clara, your program shall for each query print the pair of integers x_i and y_i — the answer for this query.

The solution will be considered correct on some test, if it will give correct answer for 96 or more queries from 100.

Examples

standard input	standard output
Alice 110...(total 1000 characters)...101 ...(98 more lines)... 101...(total 1000 characters)...111	111...(total 3000 characters)...111
Bob 11001111...(total 1000 characters)...0100 ... (98 more lines) 11110010...(total 1000 characters)...1010	0000...(total 3000 characters)...0100
Clara 11111..(total 3000 characters)...1111 00000..(total 3000 characters)...0000 10010101...(total 1000 characers)...1011 ...(98 more lines)... 00000100...(total 1000 characters)...1111	1 6 3 100 4 2 1...(96 more lines)... 8 34

Note

Your solution will be executed **three** times on each test independently: once for Alice, once for Bob and once for Clara. If the format of communications between Alice or Bob and Clara is incorrect, you will immediately receive the Wrong Answer error.

The `samples.zip` file contains the sample input for Alice, Bob and Clara; in that input Alice and Bob output all ones and all zeroes, respectively; the other data for Alice, for Bob and for Clara in this sample coincide with real test 1.