Instructions

The practice competition will begin at 11:45 AM and run until 1:00 PM. There are five problem statements provided along with a multiple choice question for each problem. We will keep a publicly visible leaderboard where the progress of all competitors on each problem can be seen. You must earn at least 1 point to get credit for participating in the competition. The competition will be scored as follows:

For each correctly answered multiple choice question, you will earn 1 point. These questions ask you to consider several different methods of attack for each problem, including what we consider to be the best approach to each problem. When you think you know the correct answer, raise your hand, tell one of the TAs, and they will grade your answer for the leaderboard. *You may try to earn each point only once. An initial wrong answer will preclude you from trying to earn this point again.*

For each correctly solved problem, you will earn 3 points. A correct solution is one that is judged correct by the Timus Online Judge. When you believe you have a correct solution to a problem, raise your hand for one of the TAs, have them watch you submit it and see that it is accepted by the judge. You may try to earn these points as many times as you like. You cannot earn both the 3 points for a correct solution and the 1 point for the correct approach for the same problem – if you do both, you will only earn 3 points.

Ties will be broken based by tracking the most recent time each competitor submits a correct solution, with competitors finishing earlier placing higher.

Problem 1: Rope.
(a) Find the shortest path on all points and in then add the length of the arcs.
(b) Use the geometrical properties of the lines and circles.
(c) Find the convex hull of the points.
(d) Perform a binary search for the length of the rope.

Problem 2: Flags.
(a) Construct basic patterns by hand and identify relationships between the answer for smaller and larger values of N.
(b) Work out a closed-form solution for the answer for any value of N.
(c) Insert flags into a priority queue and repeatedly remove the smallest length flag.
(d) Construct a graph of related flags and do a breadth-first search.

Problem 3: Mathematicians and Berries.
(a) Do a complete search of all integers within the problem limit.
(b) Construct a graph of the integers and run Dijkstra's algorithm.
(c) Work out by hand how one might calculate this and code it.
(d) Dynamic programming on the berries.

Problem 4: Cipher Message.
(a) Scan through the input string and pick out the right characters.
(b) Repeatedly delete a pair of adjacent identical characters from string until no such pairs are left.
(c) Generate possible strings and check if they can be encrypted into the input string.
(d) Construct a suffix trie and use it to answer the problem.

Problem 5: Isenbaev's Number.
(a) Use the union-find disjoint set data structure.
(b) Construct a graph with people as nodes and use Kruskal's algorithm.
(c) Design a bitmask with each person as a bit and solve the problem using bitwise operations.
(d) Construct a graph with people as nodes and do a breadth first search.

Problem 1

Rope

Timus Online Judge #1020
http://acm.timus.ru/problem.aspx?space=1&num=1020

Plotters have barbarously hammered *N* nails into an innocent plane shape, so that one can see now only the heads. Moreover, pursuing their mean object, they have hammered all the nails into the vertices of a convex polygon. After that they...it is awful... have roped off the nails, so that the shape felt upset (the rope was very thin). They've done it as it is shown in the figure.
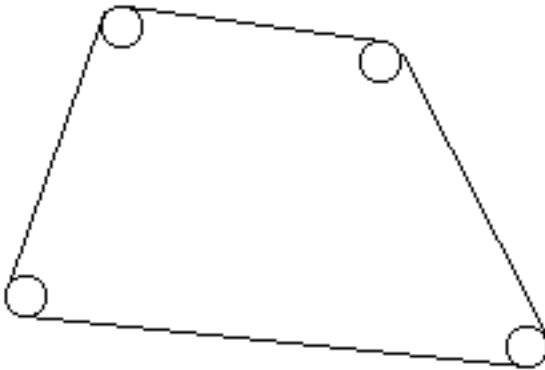
Your task is to find out the length of the rope.

Input

There are two numbers in the first line of the standard input: N — the number of nails ($1 \leq N \leq 100$), and a real number R — the radius of the heads of the nail. All the heads have the same radius. Following this line are another *N* lines, each of which contains a pair of real coordinates (separated by a space) of the centers of each nail. The absolute value of the coordinates will not exceed 100. The nails are described either in a clockwise or in a counterclockwise order starting from an arbitrary nail. Heads of different nails don't overlap.

Output

Output a real number with two digits of precision (after the decimal point) — the length of the rope.

Sample

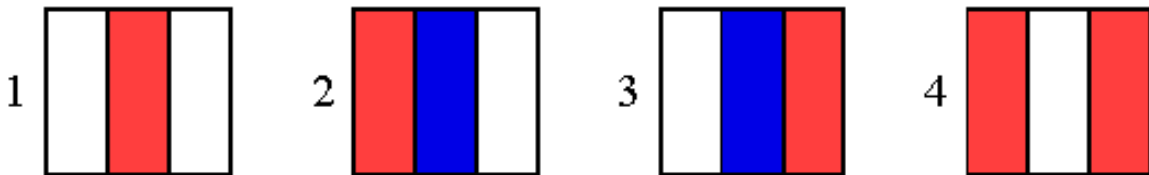| input	output
4 1 0.0 0.0 2.0 0.0 2.0 2.0 0.0 2.0	14.28

Problem 2

Flags

On the Day of the Flag of Russia a shop-owner decided to decorate the show-window of his shop with *N* textile stripes of white, blue and red colors. He wants to satisfy the following conditions:

1. Stripes of the same color cannot be placed next to each other.
2. A blue stripe must always be placed between a white and a red or between a red and a white one.

Determine the number of the ways to fulfill his wish.

Example. For *N* = 3 there are 4 possible sets of stripes:

Input
N, the number of the stripes, 1 ≤ *N* ≤ 45.

Output
M, the number of ways to decorate the shop-window.

Sample

input	output
3	4

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Problem 3

Mathematicians and Berries
Timus Online Judge #2001
http://acm.timus.ru/problem.aspx?space=1&num=2001

One day, two mathematicians were walking in the forest and picking berries. They'd been walking for two hours, and then they stopped and decided to see who had gathered more berries. They took out the scales (can you imagine a mathematician going to the forest without any scales?) and they weighed their baskets with berries. They wrote the resulting numbers a_1 and b_1 down on a piece of paper. Then the second mathematician put all his berries into the first one's basket (so that his basket became completely empty) and then weighed their baskets again and received numbers a_2 and b_2, correspondingly. At last, the first mathematician put all the berries to the second one's basket (so that his basket became completely empty); they weighed the baskets and got numbers a_3 and b_3, correspondingly. This data was enough to find the winner and the happy mathematicians moved on. Your task is to calculate the weight of the berries that each mathematician gathered.

Input
The input data consists of three lines. The i'th line $(1 \le i \le 3)$ contains integers a_i and b_i $(0 \le a_i, b_i \le 10{,}000)$.

Output
Output the weight of berries in the basket of the first and the second mathematician correspondingly.

Sample

input	output
1 2 2 1 0 3	1 1

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Problem 4

Cipher Message

Timus Online Judge #1654

Müller has tried to catch Stierlitz red-handed many times, but has always failed because Stierlitz can always find some excuse. But once Stierlitz was looking through his email messages, while at that moment, Müller secretly observed him and watched a meaningless sequence of symbols appear on the screen. "A cipher message," Müller thought.

It is known that Stierlitz ciphers messages by the following method.
1. He deletes all spaces and punctuation marks.
2. He replaces all successive identical letters by a single such letter.
3. He inserts a pair of two identical letters at arbitrary positions multiple times.

Try to restore a message as it was after the second step. For that, remove from the message all pairs of identical letters inserted at the third step.

Input

The only input line contains a message ciphered by Stierlitz. The message consists of lowercase English letters and its length is at most 200000.

Output

Output the restored message.

Sample

input	output
wwstdaadierfflitzzz	stierlitz

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Problem 5

Isenbaev's Number

Timus Online Judge #1837

http://acm.timus.ru/problem.aspx?space=1&num=1837

Vladislav Isenbaev is a two-time champion of Ural, a vice champion of TopCoder Open 2009, and absolute champion of ACM ICPC 2009. In the time you will spend reading this problem statement Vladislav would have solved a problem. Maybe, even two…

Since Vladislav Isenbaev graduated from the Specialized Educational and Scientific Center at Ural State University, many of the former and present contestants at USU have known him for quite a few years. Some of them are proud to say that they either played in the same team with him or played in the same team with one of his teammates…

Let us define *Isenbaev's number* as follows. This number for Vladislav himself is 0. For people who played in the same team with him, the number is 1. For people who weren't his teammates but played in the same team with one or more of his teammates, the number is 2, and so on. Your task is to automate the process of calculating Isenbaev's numbers so that each contestant at USU would know their proximity to the ACM ICPC champion.

Input

The first line contains the number of teams n (1≤n≤100). In each of the following n lines you are given the names of the three members of the corresponding team. The names are separated with a space. Each name is a nonempty line consisting of English letters, and its length is at most 20 symbols. The first letter of a name is capital and the other letters are lowercase.

Output

For each contestant mentioned in the input data output a line with their name and Isenbaev's number. If the number is undefined, output "undefined" instead of it. The contestants must be ordered lexicographically.

Sample

input	output
7 Isenbaev Oparin Toropov Ayzenshteyn Oparin Samsonov Ayzenshteyn Chevdar Samsonov Fominykh Isenbaev Oparin Dublennykh Fominykh Ivankov Burmistrov Dublennykh Kurpilyanskiy Cormen Leiserson Rivest	Ayzenshteyn 2 Burmistrov 3 Chevdar 3 Cormen undefined Dublennykh 2 Fominykh 1 Isenbaev 0 Ivankov 2 Kurpilyanskiy 3 Leiserson undefined Oparin 1 Rivest undefined Samsonov 2 Toropov 1