THE ICPC 2019

VIETNAM SOUTHERN PROGRAMMING CONTEST

Host: University of Science, VNU-HCM

October 20, 2019

Contest length: 5 hours

The problem set consists of 10 problems in 14 pages (*excluding the cover page*):

- Problem A: **Garden**
- Problem B: **Happy Halloween**
- Problem C: **Formik Game**
- Problem D: **The Antman In The Endgame**
- Problem E: **WalkingZ**
- Problem F: **Abstract Painting**
- Problem G: **Old MacDonald Had A Goat**
- Problem H: **Pinky Kat Challenge**
- Problem I: **Impressive Tree**
- Problem J: **Magic Lamp 1**
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- Problem L: **Magic Lamp 3**

Problem A
Garden
Time Limit: 1 second

Fresh and green! We should create a nature-friendly environment for our new city with trees and flowers. Therefore, a Marvelous Garden is going to be built in the new city.

The city is described as a convex polygon with n vertices, and the garden has a triangle shape.

Your task is to build the Marvelous Garden with the largest area in the city.

Input

The first line contains an integer n, the number of vertices of the polygon ($3 \leq n \leq 2000$).

In the next n lines, each line contains 2 integers (with absolute value not exceeding 10^7) describing the coordinates of the vertices. These vertices can be listed in either the clockwise or counter-clockwise order of the polygon.

Output

Display one number - the largest area of the garden in the city. The result has exactly one digit after the decimal place.

Sample Input	Sample Output
4 0 0 10 0 12 12 0 10	70.0

Problem B
Happy Halloween
Time Limit: 1 second

Andy is very happy because he receives so many candies during Halloween.

He has two empty bags and n types of candies. The i^{th} candy type has a_i piece(s). The candies of the same type could be put into either the two bags (bag 1 or bag 2). If the number of candies of the one type is even, Andy can ***also*** split the candies of that type into two equal parts, and each part is put into one bag.

Let S_1 and S_2 be the total candies in bag 1 and bag 2 after Andy has put all of his candies inside. He wonders if there is a way to put those candies in these bags so that the difference of the number of candies among them is minimum, which means $|S_1 - S_2|$ is as small as possible.

Input

The first line contains an integer n – the number of candy types that Andy has ($1 \le n \le 1000$).

The second line contains n natural numbers $a_1, a_2, \dots, a_n$ where a_i is the number of candies of the i^{th} type. The value of a_i does not exceed 10^5.

Output

Display one number - the value of $\max\{S_1, S_2\}$ when the absolute difference value between S_1 and S_2 is minimized.

Sample Input	Sample Output
3 12 5 3	11
4 1 2 3 4	5

Problem C
Formik Game
Time Limit: 1 second

In the far future, Fantastic Planet is preparing for an attack on the homeland of an alien race, called the Formik. Gifted children from all over the Fantastic Planet are recruited for trainings to become commanders for the new fleet of this attack.

At the end of the training, the two best students, Einder and Stilzon, compete each other in a game, called The Formik Game, to determine the commander of the fleet. The game simulates the battlefields in two zones of Formik planet. The detailed description of the game is as follows:

- The battlefields and roads in each zone form a directed acyclic graph. In each zone, a battlecruiser is initially placed at an arbitrary battlefield.
- Einder and Stilzon play in turns.
- In each turn, the player moves each battlecruiser to the adjacent battlefield, along the direction of its road in its own zone. The player must move both battlecruisers in his turn.
- The player, who cannot move at least one of the two battlecruisers in his turn, loses the game.

Einder and Stilzon are very smart and they both have extensive experience in this kind of battle. However, Stilzon is very arrogant and claims that he can win this game regardless of Einder's choice to move first or second. As Einder really wants to win the game, he now needs your help to determine which player, moving first or second, wins the game if both of them use optimal strategies in each move.

Input

The first line contains two integers n_1 and m_1 corresponding to the number of battlefields and roads of the first zone ($1 \leq n_1, m_1 \leq 100{,}000$).

Each line in the next m_1 lines contains two numbers x and y ($1 \leq x, y \leq n_1$) to represent a directed road from battlefield x to battlefield y in the first zone.

The next line contains two integers n_2 and m_2 corresponding to the number of battlefields and roads of the second zone ($1 \leq n_2, m_2 \leq 100{,}000$).

Each line in the next m_2 lines contains two numbers x and y ($1 \leq x, y \leq n_2$) to represent a directed road from battlefield x to battlefield y in the second zone.

The next line contains the number T ($1 \leq T \leq 100{,}000$) - the number of queries for this problem.

Each line in the next T lines contains two integers v_1 and v_2 ($1 \leq v_1 \leq n_1, 1 \leq v_2 \leq n_2$), where the battlecruisers are placed initially in the two zones.

Note: There can be multiple roads connecting two battlefields in a zone.

Output

For each query, print in a line "`first`" (without quotation mark) if Einder should choose to go first to win, and print "`second`" (without quotation mark) otherwise.

Sample Input	Sample Output
3 2 1 2 2 3 2 1 1 2 2 2 1 3 2	first second

Problem D
The Antman In The Endgame
Time Limit: 1 second

After Thanos destroyed haft population of the universe, Antman and the survivals in the Avenger team have to travel back in time to collect the infinity stones to reverse the destruction and revive their friends.

When travelling back in time, Antman gets lost on the 2D plane in spatio-temporal dimension. There are n square stones on this plane. All the square stones have non-zero area and there are not any two stones whose area of intersection $S > 0$. After wandering a while, he sees the exit, but he needs to find the way to get there.

He is in hurry! He needs to get out of here as soon as possible before it is too late! You have to help him find the shortest path from his current position to the exit knowing that:

- The Antman can only walk on the edges of the square stones. He can also walk between the stones if they share an edge.
- The current position of the Antman and the exit do not lie inside any square stones.
- There are not any cases that the Antman's position is identical to the exit initially.

Input

The first two lines contain the coordinate of the current coordinate of the Antman and of the coordinate of the exit.

The third line contains the number n $(1 \leq n \leq 1000)$ - the number of square stones.

The next n lines contain descriptions of the square stones. Each square is given by 4 integers which are the coordinates of 2 opposite angles, and its edges are parallel to the coordinate axes.

All coordinates are given in the format x, y, where x and y are integers that do not exceed 10^9 in absolute value.

Output

Display the shortest path from the current position of the Antman to the exit. The result has exactly six digits after the decimal place.

Sample Input	Sample Output
0 0 5 0 2 1 -1 4 2 1 -1 3 -3	5.828427

Problem E
WalkingZ
Time Limit: 1 second

During the months and years of Zombie Apocalypse, a lot of zombies wander along the roads in the state of Genesis. The special thing happens in Genesis state is that:

- The cities in Genesis state forms a complete graph.
- The name of each city is a string consists of lowercase alphabetic letters only.
- The zombies only walk on the roads connecting the cities of the state without entering the city itself. They do not walk to other roads either.
- The number of zombies on the road is the length of largest common substring of the names of the two connected cities.

A group of survivals was assigned a task to setup a set of roads, namely ***Secure Backbone***, which allows people travel safely to any city from an arbitrary city in Genesis state. According to the plan, they will need to travel through ***as little number of roads as possible*** while killing ***as many zombies as possible***. Knowing that they can travel to any city by helicopter initially to start their journey, please help them plan the optimal route to fulfill their task.

Input

The first line contains a positive integer n - the number of cities in Genesis state.
In each of the following n lines, there is a non-empty string which is the name of a city. The city's name consists of lowercase alphabet letters only.
The total length of all strings does not exceed 500,000 characters.

Output

Print the maximum number of zombies that the group of survivals can kill during their journey.

Sample Input	Sample Output
2 xaby abuv	2

Problem F
Abstract Painting
Time Limit: 1 second

Ollie is an artist and she draws abstract paintings. Her very new picture looks like a straight line with multiple line segments in many colours.

She painted it by following this order: First, she drew a segment of the first color from l_1 to r_1, then a segment of the second color from l_2 to r_2, and so on. Finally, she drew the last segment from l_n to r_n with the n^{th} color..

All segments were of n different colors, however, some might be painted over by others. Then Ollie thought: perhaps if she painted these segments in same place but in a different order, the number of visible colors in the picture will be maximum.

Your task is to help her to choose the order of drawing these segments so that the number of visible colors in the picture will be maximized. Line segments are considered closed.

Input

The first line contains an integer n $(1 \le n \le 300)$.

The i^{th} line in the next n lines contains two integers l_i and r_i $(-10^9 \le l_i < r_i \le 10^9)$ which indicate the i^{th} drawn with the i^{th} color.

Output

In the first line, output the number of colors that will be visible in the optimal drawing order.

Sample Input	Sample Output
4 1 3 2 4 2 3 1 4	3

Problem G
Old MacDonald Had a Goat
Time Limit: 1 second

Old MacDonald had a farm. As you might know from a very famous song of him, he had been raising many types of cattle such as chicken, cows, horses, ducks, etc. This time, he wants to expand his business, so he imports a new species which is the goat.

Now, MacDonald needs to build a stable for his goats. He has n fences and he loves to build the stable in a rectangle shape. In order to save space to raise other new species in the future, he limits the area of the goat's stable to be less than an positive integer S.

There are n fences, the i^{th} fence has a length of l_i. Given an integer S and a sequence of integers $l_1, l_2, \dots, l_n$. Your task is to indicate 4 positions (i, j, k, t) that these fences will form a rectangle, whose area is maximum and does not exceed S.

Input

The first line contains two integers n and S $(4 \le n \le 10^5; 1 \le S \le 10^{18})$.

The second line contains n integers $l_1, l_2, \dots, l_n (1 \le l_i \le 10^{18})$, the lengths of n fences.

Output

Display 4 integers $i, j, k, t (1 \le i < j < k < t \le n)$ – the positions of the selected fences. If the answer does not exist, output -1. If there are multiple solutions, output the tuple (i, j, k, t) which has the smallest alphabetical order.

Sample Input	Sample Output
12 19 3 4 2 6 5 9 3 9 5 4 6 2	1 4 7 11

Problem H
Pinky Kat Challenge
Time Limit: 1 second

After a Math lecture at University of Rotation, professor Pinky Kat raises a challenge to her students with a prize of 1000 Kat Coins to encourage her students to apply what they learn into real-life problems. Professor Pinky Kat loves to rotate strings, thus the challenge is also about rotating strings.

She defines a rotation manipulation on string $s_0 s_1 \ldots s_{n-1}$ by swaping the first character to the end to generate the string $s_1 s_2 \ldots s_{n-1} s_0$. For example, rotating the string `"abcd"` in turn produces the following strings: `"bcda"`, `"cdab"`, `"dabc"`.

Consider the sequence s containing only alphanumeric characters from `'0'` to `'9'`. Let S be the set of rotation strings that do not contain the leading letter `'0'` of s. Thus, each element of S is a decimal that does not contain a meaningless leading zero. She denotes $f(S)$ as a set of decimal numbers generated from the set S. For example, with s=`"2019"` then

S= {`"2019"`,`"1920"`,`"9201"`} and $f(S) = \{2019, 1920, 9201\}$.

Consider two strings s and t. Let S, T be the sets of the two rotation strings that do not contain the leading digit `'0'`of s, t respectively. The students need to find the maximum value of $|x - y|$, where $x \in f(S)$ and $y \in f(T)$. Can you to solve the problem to win the prize?

Input

The first line contains the non-empty string s. The second line contains the non-empty string t. The length of each string does not exceed 3000.

Output

Print the maximum value of $|x - y|$, where $x \in f(S)$ and $y \in f(T)$.

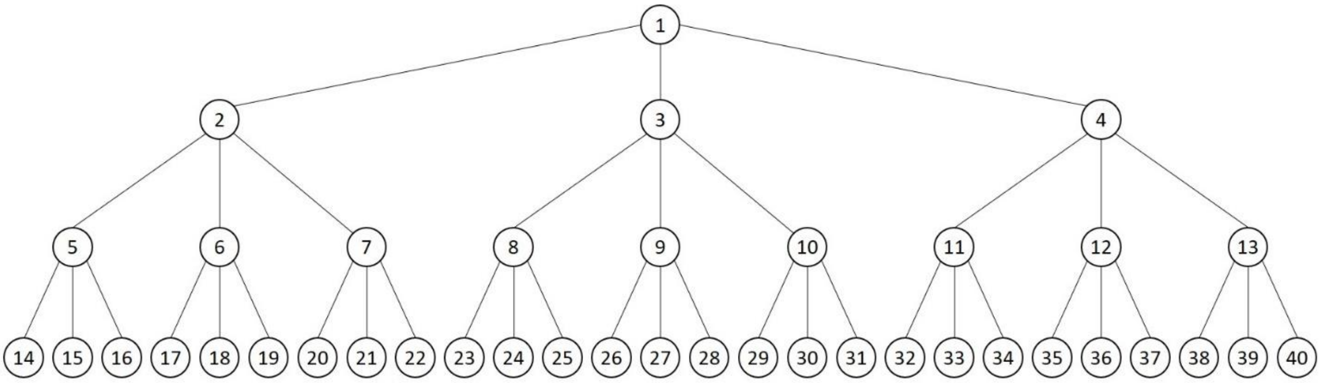
Sample Input	Sample Output
2019 2020	7181

Problem I
Impressive Tree
Time Limit: 1 second

Max has just learned about ternary tree. His lecturer gave him an assignment that requires him to traverse through a complete ternary tree by coloring its nodes.

Max really wants to impress his friend, Ollie, who is a great abstract artist. So he defined a way to color the tree so that whichever node Ollie asks, he could tell its color code right away (which is cool!).

Consider a complete ternary tree with infinite nodes (each node has exactly 3 child nodes, or no child node). The nodes are named from 1 starting from the root and keep increasing from top to bottom and left to right, as illustrated in the figure below:



At first, Max colored the root with a given RGB color. He defined a rule so that if a node has a (R, G, B) color, its child nodes will be colored as follows:

- The left child node will be colored $(R + G, B, G)$.
- The middle child node will be colored $(B, G + B, R)$.
- The right child node will be colored $(G, R, B + R)$.

Given 3 integers R, G, B which indicate the color of root node, your task is to find the color of the n^{th} node on the tree.

Input
The input contains one line with 4 integers $R, G, B, n (1 \le R, G, B \le 10^5; 1 \le n \le 10^{14})$.

Output
Output 3 integers R, G, B – the color of the n^{th} node.

Sample Input	Sample Output
3 4 5 4	4 3 8

Problem J
Magic Lamp 1
Time Limit: 1 second

You are lucky to find a magic lamp in the Cave of Numbers. The Genie of the lamp will help you fulfill three wishes if you can answer his questions.

Here is the first question of the Genie for the first wish.

Given an array A with n elements: a_1, a_2, …, a_n. Consider all $n!$ permutations of A. With each permutation, we concat all numbers to get a single number.

For example, with A = `[1,20,3]`, we will get the following 3! = 6 numbers: `1203,1320,2013,2031,3120,3201`.

Amongst these $n!$ numbers, count how many numbers are divisible by `11`.

Input

The first line contains a single integer n ($1 \leq n \leq 10^5$)

The second line contains n numbers, separated by a single space, representing the array A.

Output

Contains a single integer - the number of numbers divisible by `11`, modulo `998244353`

Sample Input	Sample Output
3 1 20 3	3

Explanation for the sample: There are 3 numbers divisible by `11: 1320, 2013, 3201`.

Problem K
Magic Lamp 2
Time Limit: 1 second

You are so smart to solve the first quest of the Genie. Are you ready for the second quest? Let's go.

Given a sequence a which is a permutation of n numbers $1, 2, \ldots, n$.

A subsequence $[l, r]$ $(1 \le l \le r \le n)$ of the permutation a is a sequence whose elements are $a_l, a_{l+1}, \ldots, a_r$. The subsequence $[l, r]$ is called a Min-Max Seque nce if its maximum and minimum values lie on both ends of that sequence.

Your task is to count the number of Min-Max Sequences of the permutation a.

Input

The first line contains an integer n $(1 \le n \le 10^6)$

The second line contains n numbers $a_1, a_2, \ldots, a_n$.

Output

Print one single integer which is the number of Min-Max Sequences of a permutation a.

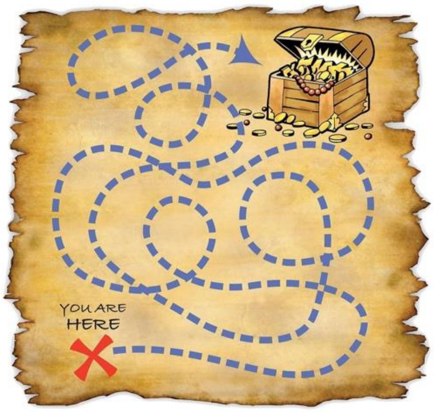
Sample Input	Sample Output
5 2 5 3 1 4	10

Explanation for the sample:

There are 10 Min-Max sequences which are: 2; 2 5; 5; 5 3; 5 3 1; 3; 3 1; 1; 1 4

Problem L
Magic Lamp 3
Time Limit: 1 second

Well done! Now is the last quiz and the Genie will show you the great treasure.



You got a number n $(n > 1)$. You are asked to decompose your lucky number into a product of multiple positive integers larger than 1. A decomposition of number n is a sequence of integers $a_1, a_2, \dots, a_k$ in which:

$$a_i > 1 \text{ for all } 1 \le i \le k$$

$$\text{and } n = a_1 \times a_2 \times \dots \times a_k \ (k \ge 1)$$

Two decompositions are considered different if the two corresponding sequences are different. Then, you need to sort all the decompositions in alphabetical order. For example, a number $n = 12$ has 8 ways to decompose which are sorted in the alphabetical order:

$$12 = 2 \times 2 \times 3$$
$$12 = 2 \times 3 \times 2$$
$$12 = 2 \times 6$$
$$12 = 3 \times 2 \times 2$$
$$12 = 3 \times 4$$
$$12 = 4 \times 3$$
$$12 = 6 \times 2$$
$$12 = 12$$

The sequences are counted from 1 after being sorted in alphabetical order.

Now, you will be given multiple number k. For each of the number k, you will need to find the the k^{th} decomposition of your lucky number.

Input

The first line contains the number n $(2 \le n \le 10^{18})$
In the next lines, each line contains a positive integer k.
The input ends with a line containing number 0.

Output

The first line contains the number of decompositions of n
With each number k which is larger than 0, output in one line the sequence which is the k^{th} decomposition of n. It is guaranteed that the decomposition always exists.

Sample Input	Sample Output
12 2 4 6 8 0	8 2 3 2 3 2 2 4 3 12