Problem A. Rivers

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

It is known, that Almaty is placed in region called Zhetisu. There are plenty of rivers in this region. There are 2 villages A (village hidden in smoke) and B (village hidden in mountains) on a map (XY plane). They are separated with n parallel rivers, each river is represented with 2 lines parallel to OX with distance w_i between them. These 2 villages are hometowns of Alimzhan and Alan respectively, so they want to be able to travel to each other. They have decided to build a bridge on each river, such that it is perpendicular to river flow. They gave you this problem, and asked you to compute the optimal placement of bridges minimizing the distance one needs to travel between villages A and B.

Input

First line contain 4 integers ax, ay, bx, by - coordinates of points A and B ($|ax|, |ay|, |bx|, |by| \leq 10^9$).

Second line contain single integer n - number of rivers ($1 \leq n \leq 10^5$).

Next n lines contain description of rivers in increasing order of y coordinate. Each of these lines contain two integers y_i, w_i ($|y_i| \leq 10^9, 0 < w_i \leq 10^9$) - river i is enclosed between lines $y = y_i$ and $y = y_i + w_i$.

It is guaranteed that $ay \leq y_1 < y_1 + w_1 < \ldots < y_n < y_n + w_n \leq by$.

Output

In first line, output minimal possible distance from A to B with optimal configuration of bridges. In next n lines, at line i output x-coordinate of bridge on river i. Relative and absolute error of your answer must not exceed 10^{-9}.

Examples

standard input	standard output
0 0 0 5 1 2 1	5.0000000000 0.0000000000
0 0 10 10 2 2 2 5 3	16.1803398875 4.0000000000 6.0000000000

Problem B. Solitare

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

Artem and Yernaz are playing the game. Artem prepared card deck with each card numbered from 1 to n and shuffled it. Now, Yernaz take card from the top of the deck one by one and decide: if he taken the card with number x, he either can put it on the top of some existing pile if the top number y is smaller than x, otherwise he can create new pile with single card x on the top. So each turn, he either puts card on the top of an existing pile or creates new one. Yernaz would like to keep as much free space on the table as possible, so he wonder what is minimal possible number of piles when at the end of the game?

Input

First line contain single integer n ($1 \leq n \leq 10^5$).

Second line contain n different integers a_i ($1 \leq a_i \leq n$) - shuffled card deck.

Output

Output single integer - answer to the problem.

Examples

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

Problem C. Extraordinary

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Daniyar claims that he found *extraordinary* sentence S of k words formed with first n letters of alphabet. The curiosity of this sentence is so, that if one applies the "Caesar cipher"to it (see note for definition), for any key K of size n it is always possible to restore initial sentence S from resulting sentence T, by changing the order of words in T (or leave as it is) and/or reordering the letters for each word of T. Note, after cipher applied, you are not allowed to move letters from one word to another. Help Daniyar to verify for a given sentence S if it is extraordinary or not.

Input

In the first line, there are two integers n, k ($1 \le n \le 26, 1 \le k \le 50000$). In the next k lines you are given words, each line contains string of first n lowercase English letters. It is guaranteed, that sum of lengths of all word does not exceed 10^6.

Output

Output string "Ya, if sentence is extraordinary, else output "Zhok"(without quotes).

Examples

standard input	standard output
2 2 aba baa	Zhok
2 2 abb baa	Ya

Note

Caesar cipher with key K (some **permutation** of letters) is defined as replacing each occurrence of letter x with letter K_x. For example if $K = cab$, then $\text{Caesar}_K(\text{"}abacaba\text{"}) = cacbcac$ ($a \to c$, $b \to a$, $c \to b$).

Problem D. Delicate systems

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Zharaskhan is been asked to design system that connects n computers. Two computers can exchange messages if they are connected with special links. To save time Zharaskhan built the minimum possible number of links so that any two computers can exchange messages directly or through other computers.

Unfortunately, these computers often break, in an odd way that only computers with consecutive indexes are broken. In such cases, Zharaskhan has to build temporary links between still working computers, in a way, that any two working computers could exchange messages. Zharaskhan is a very busy person, so he wants to build as few links as possible. Help him to find the minimum number of links he has to build!

Input

The first line contains one integer $n(1 \le n \le 10^5)$ - the number of computers.

The next $n-1$ lines describe the system. The i-th line contains two integers a_i and $b_i(1 \le a_i, b_i \le n)$, denoting the link between computers with indexes a_i and b_i. It is guaranteed that any two computers can exchange messages using these links.

The next line contains integer $m(1 \le m \le 10^5)$ - the number of cases.

The next m lines describe the cases. Each line contains two integers l_j and r_j, denoting the interval $[l_j, r_j]$ of broken computers. Each case is independent.

Output

For each case print, in separate lines, the minimum number of temporary links Zharaskhan has to build.

Example

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

Problem E. Aidana and Pita

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

Aidana loves pita a lot. Yesterday she brought home n pitas. Each pita has its own *tasteness* values, which described as an integer number.

Today 3 friends of her will come to the dinner. She'll distribute all n pitas among them, i.e. each pita to exactly one friend, each friend will be happy as much as total *tasteness* of received pita. Aidana wants to be fair, she'll try to distribute evenly, i.e. minimizing the difference between maximum and minimum among friends *happinesses*.

Aidana currently busy at work, and she asked Temirulan to help her. But Temirulan decided to give this task to KBTU Open participants.

Input

First line of input contains one integer number n ($3 \le n \le 25$) — the length of array. Second line n integers a_i ($1 \le a_i \le 10^7$) — *tasteness* of all pitas.

Output

Output n integer numbers — the optimal distribution of all pitas, i-th number id of a friend. Friends IDs are 1, 2, and 3.

Examples

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

Problem F. Good sequences

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Sequence called *good* if it has at least 1 unique element. You're given array of n integers. Count number of different pair (l, r), such that $1 \leq l \leq r \leq n$ and $a[l..r]$ is a *good* sequence.

Input

First line of input contains one integer n ($1 \leq n \leq 5 * 10^5$) — the length of array. Second line of input contains n integer numbers — the values of array, $-10^9 \leq a_i \leq 10^9$ for all $1 \leq i \leq n$.

Output

Output one integer number — answer to the problem

Example

standard input	standard output
5 1 3 3 2 2	12

Problem G. Shadow Fiends

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

Dota is a sick mental game. It brings out the best and the worst in you. It comes down to half a second where you just can't predict what's gonna happen. You try to look at everything as pieces and pawns. You try to look at it as simply the game. Who ended up winning the mental warfare always won the series, that's how you're gonna win tournaments, that's how you win the tournament. If you break the other mind it gets really easy. Some minds are really hard to beat though.

Assume you have n heroes, i-th one have a_i hit points (HP). If hero's HP reaches 0 or below, then he dies. These n heroes has remarkable spell: when hero dies he explodes dealing b_i damage to other (alive) heroes. You aim is to kill all n heroes. You can choose exactly **one target** and make any number of hits to it (1 hit = 1 HP). What is the minimal number of hits you need to make in order to kill all heroes?

Input

First line contains single integer n ($1 \le n \le 10^6$).

Second line contains n integers a_i - hit points of hero i ($1 \le a_i \le 10^9$).

Third line contains n integers b_i - explosion damage of hero i ($1 \le b_i \le 10^9$).

Output

Output "gg"if there is no way to kill them all, else output minimum number of hits required.

Examples

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

Note

Here is the video inspired for this problem: https://www.youtube.com/watch?v=-dqBj8GfMNA

Problem H. Tree enumeration

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Given natural number n and some array of numbers $a_1, \ldots, a_n$. Denote set of all possible trees on vertices with numbers $1, \ldots, n$ as $\mathbf{T}_n$. For the tree T denote $T(i)$ be a degree of vertex i in the tree T. Calculate the following sum:

$$\sum_{T \in \mathbf{T}_n} a_1^{T(1)} \cdot \ldots \cdot a_n^{T(n)}$$

As the value could be too large, output result modulo $10^9 + 7$.

Input

First line of input contain single integer n ($1 \le n \le 10^5$).

Second line contain n integers $a_1, \ldots, a_n$ ($1 \le a_i \le 10^9$).

Output

Output desired sum module $10^9 + 7$.

Examples

standard input	standard output
2 1 1	1
3 1 2 3	36

Problem I. Healing potions

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

NurlashKO is again playing his favorite RPG called Divinity: Original Sim 2.

In this game, NurlashKO's main character has H health points. Every new quest becomes tougher and tougher, so he decided to always carry some amount of potions that will always be enough to fully recover his character. Necromancer in his party has a spell "Living on the Edge" that will make its target immortal for a short period of time, so he should be able to recover even with 0 amount of health points.

Each potion in this game has its own level, represented by a positive integer from 1 to k. Drinking a potion of level i will increase characters' current health by 2^{i-1}.

Local alchemist sells potion of level i for C_i gold coins.

Please help NurlashKO to find the cheapest way to get the required supply of health potions.

Input

The first line contains 2 integers H and k ($1 \le H \le 10^9, 1 \le k \le 30$) — NurlashKO's health and number of different potions.

The second line contains k integers $C_1, C_2, ..., C_k$ ($1 \le C_i \le 10^9$), where C_i is the cost of potion level i.

Output

Print the answer — the minimum amount of gold coins NurlashKO should spend to consider himself safe on his journey.

Examples

standard input	standard output
15 5 5 15 18 25 45	45
9 4 5 9 50 100	41

Note

In the first sample, you should just buy a potion level 5. It restores 16 HP which is enough.

In the second one, you should buy one level 1 potion and four level 2 potions.

Problem J. Special contest

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Examples

standard input	standard output
2019	3
2020	2
2012	3

Note

If the answer is undefined, output most probable value.