Problem A. Antiquities of Acre

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Light Blue`

Aamer bin Abdullah bin Al-Jarrah Al-Fihri, traveling through the lands of Palestine, explores Acre's labyrinthine alleys and towering walls, immersing himself in a city celebrated for over 4,000 years as a bastion of resilience and cultural diversity. Acre's strategic location on the Mediterranean coast has fostered a rich tapestry of civilizations and architectural marvels.

We have a hidden array arr of size n. All elements of the array initially are equal to x, except for one element which is equal to y. You are given the values of n, x, and y.

Your task is to find the index of the element y. You are allowed to make at most 20 queries. Each query will be answered by the interactor described below.

```
1. Initialize variable n to be the size of the array arr.
2. Initialize the variable index as a random integer from 1 to n.
3. Initialize arr as a list of (n - 1) numbers by x values and only one item as a y value.
4. Initialize old as an empty set of pairs of integers.
5. Initialize infected as a list of integers initially all values are zeros except infected of inc

6. Function QueryAnswer():
7.     Read QueryType as a character from input
8.     If QueryType is '!':
9.         Read indexInput as an integer
10.        If indexInput is not equal to index:
11.            Return "WA"
12.        Else:
13.            Return "OK"
14.    If QueryType is not '?':
15.        Return "WA"
16.    Read l and r as integers
17.    Create a pair p from l and r
18.    If p is in old set Or l greater than r Or l less than 1 Or r greater than n:
19.        Return "WA"
20.    Add p to old set
21.    Initialize sum to 0
22.    For each i from l to r:
23.        Read weight as a long integer
24.        If weight <= 0 Or weight > $10^9$:
25.            Return "WA"
26.        sum = sum + (arr[i] * weight)
27.
28.    For each j from index to 0:
```

```
29.         If j is between l and r:
30.             For each i from j to 0:
31.                 Set infected[i] to 0
32.             Break
33.         If infected[j] is 1:
34.             Decrement arr[j] by 1
35.         Else:
36.             Set infected[j] to 1
37.             Decrement arr[j] by 1
38.             Break
39.
40.     For each j from index + 1 to n:
41.         If j is between l and r:
42.             For each i from j to n:
43.                 Set infected[i] to 0
44.             Break
45.         If infected[j] is 1:
46.             Decrement arr[j] by 1
47.         Else:
48.             Set infected[j] to 1
49.             Decrement arr[j] by 1
50.             Break
51.
52.     Set infected[index] to 1
53.     Return sum
```

Input

A single line consisting of three space-separated integers n, x and y $(2 \leq n \leq 10^5), (1 \leq x, y \leq 10^5)$ and $(x \neq y)$.

Output

Print the index of y.

Interaction Protocol

You can make up to 20 queries.

To make a query print a character '?' or '!', if the printed character is '?', then you should print l and r, $(1 \leq l \leq r \leq n)$ then You should print $(r - l + 1)$ values, all values should be greater than zero and less than or equal to 10^9.

You get one integer as a response as in the interactor, WA means that the program will terminate and you will get a Wrong answer verdict. if the printed character is '!' then you should print one integer, the index of y, then the interactor will no longer accept any input. You get one integer as a response as in the interactor, WA means that you get the wrong answer verdict, and OK means that you did find the index of y and you get the Accepted verdict.

After outputting a query, ensure you end the line and flush the output to avoid a Time Limit Exceeded **TLE** verdict. To flush the output, use:

- fflush(stdout) or cout.flush() in C++,
- System.out.flush() in Java,
- stdout.flush() in Python.

Example

standard input	standard output
3 1 2 3 5 0	? 1 2 1 2 ? 1 1 5 ? 3 3 1 ! 3

Problem B. Biblical Journeys in Bethlehem

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Bronze`

Aamer journeys to Bethlehem, renowned as the birthplace of Jesus Christ and steeped in over 3,000 years of biblical history. Nestled among Judea's hills, Bethlehem's ancient streets echo tales of prophets, pilgrimage, and enduring faith, making it a timeless symbol of spiritual heritage.

You are standing in line to fill gasoline. The line has N people and you are the $(N+1)$-th person.

Each person in the line $1 \leq i \leq N$ takes time D_i to finish filling up with gasoline and patience P_i. If their waiting time exceeds P_i, they get angry and leave.

Calculate the time required until you can start filling gasoline.

Input

The first line contains a single integer T ($1 \leq T \leq 10^3$), the number of test cases.

The first line of each test contains a single integer N ($1 \leq N \leq 10^6$).

Then you are given N lines:

Each containing two space-separated integers D_i, P_i ($1 \leq D_i \leq 10^5, 1 \leq P_i \leq 10^9$).

It is guaranteed that the sum of N over all test cases does not exceed 10^6.

Output

For each testcase, print one line containing a single integer, the answer for the testcase.

Example

standard input	standard output
1 3 1 100 1 100 1 100	3

Problem C. Canals of Beersheba

Input file: `standard input`
Output file: `standard output`
Balloon Color: `White`

Aamer explores Beersheba's intricate network of canals and ancient water management systems, critical lifelines in the Negev Desert for millennia. Beyond their practicality, these systems highlight Beersheba's ingenuity and pivotal role as a crossroads of trade and civilization in arid landscapes.

Consider the following equation:

$$12 \cdot n^2 + 3 \cdot a^2 + 3 \cdot b^2 = 12 \cdot a \cdot n + 12 \cdot b \cdot m - 12 \cdot m^2 + 12 \cdot c$$

You are given the three integers a, b, and c. Your task is to find the value of n and m, or to state that no solution exists.

NOTE: n and m might not necessarily be integers.

Input

The first line of input contains a single integer t ($1 \leq t \leq 10^5$). The number of test cases.

The second line of input contains three space-separated integers a, b, and c ($1 \leq a, b \leq 10^9$), ($-10^9 \leq c \leq 0$).

Output

For each test case, print one line containing n and m if the given equation is solvable and -1 otherwise.

The solution is accepted if the absolute or relative error of the output does not exceed 10^{-9}.

Namely, if your answer is a, and the judge answer is b, then your answer is accepted, if $\frac{|a-b|}{\max(1,|b|)} \leq 10^{-9}$.

Example

standard input	standard output
2 99938 544172 -562 1 10 0	-1 0.5000000000 5.0000000000

Problem D. Diverse Culture of Al-Khalil

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Green`

Al-Khalil beckons Aamer with its bustling markets and ancient streets, reflecting a city that has thrived as a cultural crossroads for over 4,000 years. Revered by Christianity, and Islam alike, al-Khalil's vibrant mosaic of cultures and traditions enriches its identity as a hub of commerce, faith, and cultural exchange.

You have a long street of length N, and you want to install some lamps to light some segments of the road. So you will be given Q queries of two kinds:

1 L R : Install a lamp that can light the segment from L to R.

2 L R : What is the minimum number of installed lamps needed to light the segment $[L, R]$, more formally, find the number of the smallest group of installed lamps such that the combined segments they light up fully cover the segment from point L to point R.

Input

The first line contains one integer N ($1 \leq N \leq 2 \times 10^5$). The length of the street.

The second line contains one integer Q ($2 \leq Q \leq 2 \times 10^5$). The number of queries.

Then follows Q lines. The i-th line contains three integers t_i L_i R_i. ($t_i \in \{1, 2\}$, $1 \leq L_i \leq R_i \leq N$). Which represents the i-th query.

It is guaranteed that there is at least one query of type 2.

Output

For each query of type 2, output one line containing its answer or -1 if the answer doesn't exist.

Examples

standard input	standard output
7 5 1 1 3 1 3 6 1 7 7 2 2 5 2 1 7	2 3
5 3 1 1 4 1 1 4 2 1 5	-1
5 5 1 1 1 1 2 2 1 3 3 2 1 3 2 1 4	3 -1

Problem E. Exploration of Jericho's Oases

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Light Green`

Jericho captivates Aamer with its ancient oases and desert landscapes, emblematic of a city steeped in over 10,000 years of human settlement. Beyond its natural beauty, Jericho's resilience and archaeological treasures reflect its enduring role as a cultural and historical gem of the Levant region.

There is a cannon that is trying to hit its target. The target is a lattice point, and the cannon is represented by an angle that is formed from edges AB and CB, where A, B and C are also lattice points.

When the cannon shoots, the shot will travel from point B infinitely in a straight line along the vector v that is a bisector to the angle.

In order to aim at the target, you can rotate only one of the edges of the cannon, and when rotating the edge, vector v will rotate in the same direction in order to keep being a bisector for the cannon angle.

You want to know whether you can rotate the edge of the cannon in order to aim at the target or not.

Note that the cannon's barrel is towards the smaller angle (look at the illustration for more understanding). Note that the cannon angle cannot be less than or equal to 0^o and cannot be greater than or equal to 180^o.

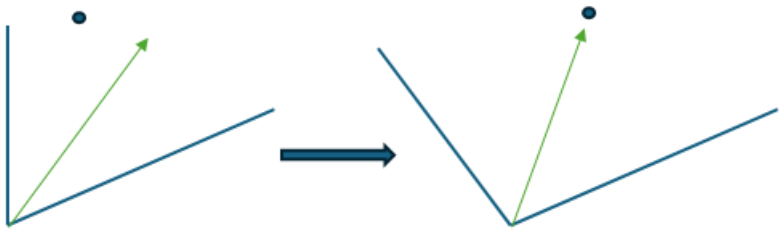


Illustration shows how the side of the cannon rotates in order to rotate vector v and aim correctly at the target.

Given the coordinates of points A, B, C and the target's coordinate and which edge is rotatable, tell whether it is possible to aim at the target or not.

Input

The first line of input will contain a single integer $t(1 \leq t \leq 10^5)$, the number of testcases you are going to answer.

Then t lines will follow where line i will describe the i_{th} testcase.

Each of the t lines will contain nine integers:

x_A, y_A, x_B, y_B, x_C, y_C, x_t, y_t, s $(-10^9 \leq x_A, y_A, x_B, y_B, x_C, y_C, x_t, y_t \leq 10^9)$, $(0 \leq s \leq 1)$ where each pair of (x, y) is describing the position of the respective point, s is telling which side of the cannon is rotatable (0 if side AB is rotatable, 1 if side BC is rotatable).

It is guaranteed that vector AB and vector BC are not collinear, and no two points have the same coordinates.

Output

For each test case, output "YES" if you can aim at the target, and "NO" otherwise.

If the answer is "YES", output the angle at which the side of the cannon has to rotate, in a new line (The angle of rotation is considered negative if the rotation is clockwise and vice verse).

The solution is accepted if the absolute error of the output does not exceed 10^{-6}.

Example

standard input	standard output
4 -1 1 0 0 1 1 3 3 0 -1 1 0 0 1 1 3 3 1 0 5 0 0 3 4 3 3 1 0 5 0 0 3 4 1000000000 1 1	NO NO YES -53.1301023542 YES -143.1301022396

Problem F. Fishing Traditions of Tiberias

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Blue`

Aamer explores Tiberias, where ancient fishing traditions intertwine with spiritual significance and healing practices dating back over 2,000 years. Set on the shores of the Sea of Galilee, Tiberias continues to embody a harmonious blend of nature, tradition, and spiritual renewal.

Bisher asks you to calculate the following:

$$\sum_{i=1}^{n}\sum_{j=1}^{n} lcm(a_i, a_j) \cdot lcm(i, j)$$

Which means the sum of $lcm(a_i, a_j)$ multiplied by the lcm of their indices, over all pairs (i, j) $(1 \le i, j \le n)$

Where $lcm(x, y)$ is the least common multiple of x and y.

Input

The first line of the input contains a single integer n $(2 \le n \le 10^5)$.

The second line of the input consists of n space-separated integers $a_1, a_2, \ldots, a_n$ $(1 \le a_i \le 10^5)$.

Output

Output a single integer — the answer to the problem, taken modulo $10^9 + 7$.

Example

standard input	standard output
5 3 6 2 1 4	937

Problem G. Gateways of Beisan

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Orange`

Beisan, known historically as Beit She'an, invites Aamer to uncover its archaeological wonders and strategic significance in the Jordan Valley. For over 5,000 years, Beisan's ancient gateways have served as conduits of cultural exchange and testament to its enduring legacy as a pivotal junction of civilizations.

Anas has a folder on his computer that has only one file. The file name is s that has n lowercase Latin letters numbered from 1 to n. Anas would like to do the following instructions every second until the system breaks:

- Choose a random lowercase Latin letter x.
- Make a new string t which is initially equal to s.
- An integer number i ($0 \leq i \leq n$) is chosen randomly and x is inserted after the first i characters in t. For example, if $t =$ "abc", $x =$ "d" and $i = 1$, then t would be "adbc".
- Add a new file in the folder with the name t.
- If there is already a file with the name t, the system will break. Otherwise, Anas will repeat the process.

Note that when Anas does multiple operations, they are all performed on the initial string s. In other words, all of the resulting strings t will be of length $n + 1$, so the operations don't stack.

What is the expected number of seconds until the system breaks?

Input

The first and only line of input contains a string s ($1 \leq |s| \leq 10^4$) where $|s|$ is the length of string s. The initial file's name. It is guaranteed that s contains only lowercase Latin letters.

Output

Print a single line containing a single integer — the expected number of seconds until the system breaks, taken modulo $10^9 + 7$.

It is guaranteed that the answer can always be represented as an irreducible fraction $\frac{a}{b}$, where $b \bmod (10^9 + 7) \neq 0$; you have to print $a \cdot b^{-1} \mod (10^9 + 7)$.

Examples

standard input	standard output
americaya	68929374
hellohellohellohello	842124588

Problem H. Harbor Life in Jaffa

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Yellow`

Aamer immerses himself in the vibrant harbor life of Jaffa, where maritime activity has shaped its identity as a gateway for trade and cultural interaction. Navigating through its bustling waters, Jaffa's strategic importance and historical role as a hub of connectivity come alive amidst the ebb and flow of commerce.

You are given an array a of n integer numbers. You need to process q queries each of which follows one of the following formats:

- 1 l r x. For each integer number a_i where. ($l \leq i \leq r$), apply $a_i := a_i \& x$, where & is the bitwise AND operator.
- 2 i x. Apply $a_i := x$.
- 3 l r. For the subarray $a_l, a_{l+1}, a_{l+2} \ldots a_r$, print the maximum XOR of a subset of integers of the subarray.

A subarray is a contiguous part of the array.

A subset of an array is a tuple that can be obtained from the array by removing some (possibly all) elements of it.

Input

The first line of the input contains a single integer number t ($1 \leq t \leq 10^4$) — The number of test cases.

The first line of each test case contains two space separated integer numbers n and q ($1 \leq n, q \leq 10^5$). The number of integer numbers of a and the number of queries, respectively.

The second line of each test contains n space separated integer numbers a_i ($1 \leq a_i \leq 10^5$), where a_i is the $i - th$ integer number of a.

Each of the following q lines follows one of the following formats.

- 1 l r x ($1 \leq l \leq r \leq n, 1 \leq x \leq 10^5$).
- 2 i x. ($1 \leq i \leq n, 1 \leq x \leq 10^5$).
- 3 l r. ($1 \leq l \leq r \leq n$).

It is guaranteed that the sum of n over all of the test cases does not exceed 10^5.

It is guaranteed that the sum of q over all of the test cases does not exceed 10^5.

Output

For each query of the third type for each test case, print a single line containing a single integer number. The maximum XOR of a subset of integers of the subarray given in the query.

Example

standard input	standard output
1 5 5 4 1 8 9 6 1 1 5 8 3 2 4 2 2 3 3 2 4 3 2 4	8 11 11

Problem I. Interwoven Cultures of Nablus

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Purple`

Nablus's winding streets and lively markets reflect a city that has flourished as a commercial and cultural center for over 2,000 years. Offering Aamer a glimpse into its history, he discovered how Nablus has been considered the main commercial and industrial center in Palestine, and even well-known for its sweets like Nabulsi Kunafa.

You are given a string S of n Latin characters, and an array A of n integers. Each element has a value of A_i. Find the length of the longest good substring.

A substring $S[l, r]$ $(1 \leq l \leq r \leq n)$ is considered good if both of the conditions below are true:

1. $S[l, r]$ is a palindrome ($S_{l+i} = S_{r-i}$ for all $0 \leq i \leq r - l$)

2. $A_l|A_{l+1}|...|A_{r-1}|A_r = \sum_{i=l}^{r} A_i$, where | is the bitwise OR operator.

Noot: x|y means x bitwise or y.

Input

The first line contains the number of test cases ($1 \leq t \leq 10^3$).

The first line of each test case contains n ($1 \leq n \leq 10^5$).

The second line of each test case contains a string S of length n.

The last line of each test case contains n space-separated integers $A_1, A_2, ..., A_n$ ($1 \leq A_i \leq 10^9$) — the array A.

It is guaranteed that the sum of n over all test cases does not exceed $3 \cdot 10^5$.

Output

For each test case, print one integer:

The maximum length of a substring that fulfills both of the conditions above.

Example

standard input	standard output
3 4 aaaa 1 2 3 4 1 a 10 6 abbabb 1 2 3 4 8 7	2 1 3

Problem J. Journey in Safed's Mysteries

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Silver`

Safed beckons Aamer with its mystical allure and spiritual significance, steeped in over 2,000 years of cultural and historical richness. As he navigates its winding alleys and sacred sites, Safed's reputation as a spiritual beacon, offering moments of contemplation and discovery.

Given an array a of length n, which may contain **negative integers**.

We define the beauty of a prefix $a[1, i]$ $(1 \leq i \leq n)$ as the maximum possible subarray sum that can be obtained from that prefix by applying the following operation at most once: select two indices x and y $(1 \leq x, y \leq i)$, and swap a_x with a_y.

Your task is to **find the beauty of each prefix of** a.

Input

The first line of the input contains a single integer n $(1 \leq n \leq 10^6)$, representing the length of the array.

The second line of the input contains n space-separated integers $a_1, a_2, ..., a_n$ $(-10^6 \leq a_i \leq 10^6)$, representing the array a.

Output

Output one line containing n space-separated integers, representing the beauty of each prefix of a.

Example

standard input	standard output
4 -2 3 -4 5	0 3 3 8

Note

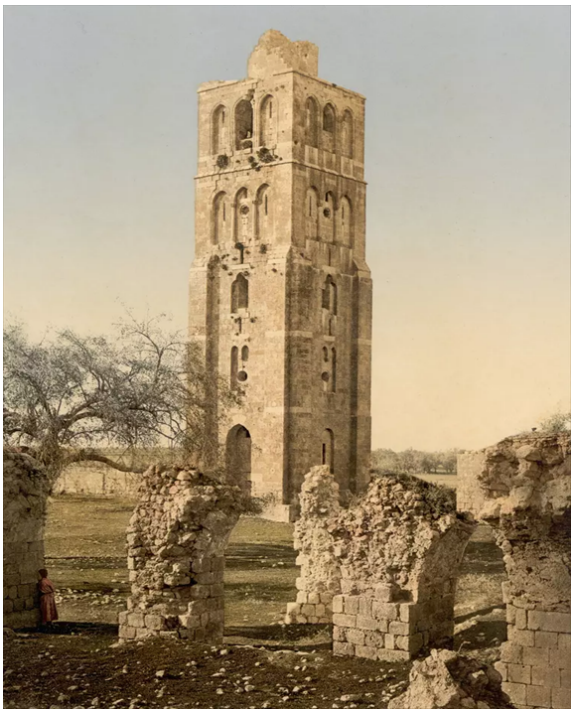
For prefix of length 1, the subarray whose sum is the maximum possible is the **empty subarray**, which has a sum equal to 0.

For prefixes of lengths 2 and 3, the subarray whose sum is the maximum possible is the subarray containing only the second element, which has a sum equal to 3.

For prefix of length 4, it's optimal to swap $a_2 = 3$ and $a_3 = -4$. Then, the subarray whose sum is the maximum possible is the subarray $a[3, 4]$ which has a sum equal to 8.

Problem K. Kaleidoscope of Ramla's Diversity

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Black`



Ramla's urban landscape reveals layers of cultural diversity and historical heritage spanning over 1,300 years. Founded during the early Islamic period, Ramla's streets and markets showcase its role as a vibrant hub of trade, agriculture, and religious tolerance, shaped by centuries of multicultural influence.

Majed didn't understand why his parents always told him to turn off the lights when leaving a room, until he had kids and started paying the bills himself. Then, he realized how these small actions could save a lot of money.

One day, Majed came home and saw that all the lights were on. He started telling his kids how this would waste a lot of money. He explained that leaving the lights on when no one is using them makes the electricity bill go up.

Majed's apartment has n lights. Each light i costs a_i pounds per hour to keep on. To show his kids how much money they are wasting by leaving all the lights on, he needs to calculate the total cost of running all the lamps for one hour, but he's not so good at math. Can you help him?

Input

The first line of the input contains a single integer number t ($1 \leq t \leq 10$). The number of test cases.

The first line of each test case contains a single integer number n ($1 \leq n \leq 10^5$). The number of lamps in Majed's apartment.

The second line of each test case contains n space-separated integer numbers $a_1, a_2 ... a_n$, where a_i ($1 \leq a_i \leq 10^4$) is the cost of lighting the $i - th$ lamp for an hour.

Output

For each test case, print a single line containing a single integer number. The total cost of lighting all the lamps for one hour.

Example

standard input	standard output
1 3 1 4 3	8

Problem L. Logistics of Lod's Connectivity

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Gold`

The city of Lod is located to the southeast of the city of Jaffa, about 15 km away from it, and to the northeast of the city of Ramla, about 5 km away from it. Lod is 50 meters above sea level. It occupies an important position as it is a transportation node where railway lines meet and it is the meeting point of Jaffa, Haifa, Al-Quds and Egypt, and through it the traveler can move from Egypt to Palestine and then to Lebanon and Turkey.

Ammar found 2 permutations a and b of length n.

While he was taking them home, he lost exactly 1 element from each permutation but the elements didn't change order. More formally, if the permutation was $p_1, p_2, \ldots, p_n$. And the i_{th} element was lost, it becomes $p_1, p_2, \ldots, p_{i-1}, p_{i+1}, \ldots, p_n$.

Ammar doesn't remember the initial permutations, but he wants you to restore any two permutations that have the maximum possible $\sum_{i=1}^{n} |a_i - b_i|$. If there are multiple answers, print any.

Input

The first line contains a single integer n ($2 \le n \le 3 \cdot 10^5$) — the length of the original permutations.

The second line contains $n-1$ integers a ($1 \le a_i \le n$) — the remaining elements of a.

The third line contains $n-1$ integers b ($1 \le b_i \le n$) — the remaining elements of b.

It is guaranteed that a and b are permutations with one element removed.

Output

On the first line print a single integer which is the maximum value of $\sum_{i=1}^{n} |a_i - b_i|$ possible.

Then, on the second and third lines print a and b respectively. If there are multiple answers, print any of them.

Examples

standard input	standard output
3 1 3 1 2	4 1 3 2 3 1 2
4 3 4 1 3 4 1	6 3 4 1 2 3 2 4 1
5 3 4 1 5 5 4 2 3	12 3 4 1 5 2 5 1 4 2 3

Problem M. Majestic Crossroads Al-Nasserah

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Red`

Al-Nasserah in the heart of Lower Galilee, overlooks the Marj Ibn Amer plain and serves as a transition between this plain and the mountainous Upper Galilee. Historically significant, it connected main roads between Syria, Egypt, Jordan, and Palestine, attracting commercial caravans.

You are given an array a of n integer numbers. You need to answer q queries. In each query you are given an integer x. You need to count the number of subarrays $a_l, a_{l+1}, a_{l+2} \dots a_r$ that satisfy for each i where $l \leq i < r$, the inequality $a_i + (i - l) * x \leq a_{i+1} + (i - l + 1) * x$ is satisfied.

Input

The first line of the input contains a single integer number t ($1 \leq t \leq 100$). The number of test cases.

The first line of each test case contains two space-separated integer numbers n and q ($2 \leq n \leq 10^5$) ($1 \leq q \leq 10^5$). The number of integer numbers in the array a and the number of queries, respectively.

The second line of each test case contains n space-separated integer numbers $a_1, a_2 \dots a_n$ ($-10^9 \leq a_i \leq 10^9$), where a_i is the $i - th$ number in the array a.

The third line of the input contains q space-separated integer numbers $x_1, x_2 \dots x_n$ ($-10^9 \leq x_i \leq 10^9$), where x_i is the parameter of the $i - th$ query.

It is guaranteed that the sum of n over all of the test cases does not exceed 10^5.

It is guaranteed that the sum of q over all of the test cases does not exceed 10^5.

Output

For each test case print a single line containing q space-separated integer numbers, where the $i-th$ number is the answer to the $i - th$ query.

Example

standard input	standard output
2 2 1 -6 -7 1 8 4 -11 -12 -20 -11 15 -20 11 -6 1 8 -20 17	1 5 11 2 13

Problem N. Navigation Challenges in Gaza

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Pink`

Gaza City's turbulent history and strategic significance shape Aamer's exploration of its intricate urban landscapes. Founded over 4,000 years ago, Gaza's resilience amidst challenges reflects its enduring spirit and the complexities of navigating humanitarian aid and development in a dynamic and diverse environment.

You are given an array a of length n. Let's say that element a_i *eats* element a_j $(i < j)$ if the range sum of array a from i to k for every k from i to $j-1$ is greater than or equal to a_{k+1}. More formally, a_i eats a_j if $sum_{i,k} \geq a_{k+1}$ for $(i \leq k < j)$ where $sum_{l,r}$ is the sum of array elements from l to r $(a_l + a_{l+1} + ... + a_r)$. For more explanation, if the following is satisfied then a_i eats a_j:

- $a_i \geq a_{i+1}$
- $a_i + a_{i+1} \geq a_{i+2}$
- $a_i + a_{i+1} + a_{i+2} \geq a_{i+3}$
- ....
- $a_i + .. + a_{j-1} \geq a_j$

We define $distance_j$ as the minimum value of $j - i$ where $i < j$ and a_i can *eat* a_j. In case there is no a_i that *eats* a_j, then the *distance* of a_j is 0. Print the sum of *distances* of all array elements.

Input

The first line of the input contains a single integer n — the length of the array a $(1 \leq n \leq 2 \cdot 10^5)$.

Each of the following n lines contains one integer a_i — the i_{th} element of the array a $(1 \leq a_i \leq 10^9)$.

Output

For each test print a single integer — the sum of *distances* of all array elements.

Examples

standard input	standard output
1 1	0
2 2 1	1
3 2 1 3	3

Note

In the first testcase, $distance_1$ is 0 because there is no element that can *eat* a_1 so the answer is 0.

In the second testcase, $distance_1 = 0$ and $distance_2 = 1$ because a_1 can *eat* a_2 so the answer is $0 + 1 = 1$.

In the thirst testcase, $distance_1 = 0$, $distance_2 = 1$ and $distance_3 = 2$, and $distance_3 = 2$ because a_2 cannot *eat* a_3 but a_1 can *eat* a_2 then a_3. The answer is $0 + 1 + 2 = 3$.

Problem O. Urban Exploration in Al-Quds

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Rose`

Aamer embarks on a journey through Al-Quds, a city revered for over 4,000 years as a cultural and spiritual crossroads. From ancient paths to sacred sites, Al-Quds's enduring significance and historical tapestry come alive, offering Aamer insights into its profound influence on global civilizations and faiths.

We have n computers running on a system, the computers form a **tree** rooted at node 1.

Each computer has a latency value. Let's define the power of a computer as the minimum bitwise XOR between its latency and the latency of any computer of its ancestors.

When a task is assigned to a computer, all computers in its subtree will work to finish this task. A computer will fail if it's working on a number of tasks that exceeds its power.

You have to answer q queries, each of them contains a computer, for each query: calculate the maximum number of tasks that could be assigned to this computer, such that all the computers in its subtree won't fail (inculding itself).

Input

The first line of input contains a single integer n ($2 \leq n \leq 3 \cdot 10^5$) – the number of computers.

The next line contains $n-1$ integers $p_2, p_3, ..., p_n$ — the parents of computers from the second to the $n-th$ ($1 \leq p_i < i$).

The next line contains n integers representing the latency array ($0 \leq latency_i \leq 3 \cdot 10^5$).

The next line contains a single integer q ($1 \leq q \leq 3 \cdot 10^5$), representing the number of queries.

Each of the next q lines contain a single integer $computer_i$ ($2 \leq computer_i \leq n$), representing the queries.

Output

For each query, print a single line containing its answer.

Examples

standard input	standard output
3 1 1 4 2 4 1 2	6
3 1 2 2 4 3 1 3	1
4 1 1 1 0 2 3 4 3 2 3 4	2 3 4