Problem A. Opening

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

Let's travel to the year 2030 and explore Palestine, a fascinating land. Meet Hanzala, a brave young boy who will be our guide. We'll spend some time there and Hanzala will take us on a journey to the famous cities, where we'll discover their rich history and culture, and solve exciting mysteries along the way. Get ready for an amazing adventure, filled with exploration and surprises, as we explore the beautiful landscapes of Palestine together.

Once upon a time, in a quaint little town, Youssef found himself deeply infatuated with Mariam, a charming young woman whose intellect matched her beauty. One sunny afternoon, filled with the courage of newfound love, Youssef gathered all his courage to ask Mariam out on a date. However, instead of a simple 'yes' or 'no', Mariam posed a perplexing challenge to Youssef.

She handed him a slip of paper with a single integer written on it — n. With a cryptic smile, she said, "If you can solve this equation, then perhaps we can consider our date." The equation was as follows:

$$\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = \frac{1}{n}$$

Youssef, eager to impress Mariam, took the challenge to heart. However, despite his best efforts, the solution eluded him. Years passed, but the memory of that day lingered in Youssef's heart, a reminder of the love he never forgot. Now, after five long years, the memory resurfaced, but the solution remained lost to him, leaving him feeling melancholic.

With a heavy heart, Youssef seeks your help, not just to crack the mathematical puzzle, but to reignite the spark of his romantic memory. Can you help Youssef find **the distinct values** of x, y, and z that satisfy the equation for the given integer n? With your assistance, Youssef hopes to rediscover the joy of that fateful day and finally unlock the key to his long-lost love story.

Input

The first line contains a single integer t $(1 \le t \le 100)$ — the number of testcases.

Each test contains one line containing a single integer n $(1 \le n \le 10^8)$.

Output

For each test case, print three **distinct** integers on a single line — $x, y,$ and z where$(1 \le x, y, z \le 10^9)$

Example

standard input	standard output
2	6 9 18
3	10 15 30
5	

Note

The three numbers should all be distinct.

Problem B. Nablus

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

Craving a taste of history? Nablus offers the legendary Kunafa, a luxurious cheese pastry soaked in syrup. The secret ingredient is Nabulsi cheese, a brined delicacy famous throughout the region. But Nabulsi's culinary magic doesn't stop there. This versatile cheese adds a salty layer to any dish. This melt-in-your-mouth masterpiece is a true testament to the city's culinary prowess.

Given a string s of length n, for each length from 1 to n, output the start of the lexicographically smallest substring with that length. If there are multiple starts, output the earliest one.

Input

Each test consists of multiple test cases. The first line contains a single integer t ($1 \leq t \leq 10^5$) — the number of test cases. Then follows their descriptions.

For each test case:

The first line contains an integer n ($1 \leq n \leq 5 \times 10^5$) – the length of the string s.

The second line contains the string s consisting of lowercase English letters.

It is guaranteed that the sum of n over all test cases won't exceed 5×10^5.

Output

For each test case, output a single line containing n integers separated by spaces. The i-th integer should represent the starting index of the lexicographically smallest substring of length i.

Example

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

Problem C. Al Khalil

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

 In the fading light of Al-Khalil, Amira, Youssef, and Leila gathered around Grandma Aisha to tell them a story. "As the sun sets over our beloved city, the Ibrahim Mosque casts its ancient shadow over the cobblestone streets,"she began. "Built by the Mamluks to honor the patriarchs, it has witnessed centuries of trials and triumphs. Remember, my children, our city's history is a story of resilience and hope."The children listened, captivated by their grandmother's words, as the ancient city's tales unfolded before them.

Given a tree of n nodes, each node has a value a_i written on it.

We define the **number of covered ranges** in a connected component as the minimum size of a set of ranges (represented by pairs $[l, r]$), such that all the following conditions are satisfied:

1. For each range $[l, r]$ in the set, and for each i such that ($l \le i \le r$), there is **at least** on node u that belongs to the connected component, such that a_u is equal to i.

2. For each node i in the connected component, there is exactly one range $[l, r]$ in the set, such that ($l \le a_i \le r$).

3. The size of the set is **as minimum as possible**.

We define $f(u)$ for some node u as the following:

1. Remove the node u from the tree (and remove all edges connected to this node.

2. Let v be equal to 0 initially. For each connected component in the resulting forest, add the number of covered ranges in this connected component to v.

3. $f(u)$ will be equal to v.

Your task is to find the value of $f(i)$ for each i from 1 to n.

Input

The first line of the input contains a single integer n ($1 \le n \le 2 \times 10^5$), representing the size of the tree.

The second line of the input contains n integers $a_i, a_2, ..., a_n$ ($1 \le a_i \le 2 \times 10^6$), representing the values written on the nodes.

Each of the next $n - 1$ lines contains two integers u and v (between 1 and n), representing the edges of the tree.

It's guaranteed that the input forms a valid tree.

Output

Print a single line containing n integers - $f(1), f(2), ..., f(n)$.

Examples

standard input	standard output
4 1 2 1 3 1 2 1 3 2 4	2 2 1 1
9 7 6 4 5 1 2 3 2 5 1 2 2 3 3 5 4 2 3 6 6 7 6 8 4 9	1 3 3 3 1 4 2 1 1

Problem D. Gaza

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

Gaza's cultural richness unfolds through its cherished handicrafts and culinary delights. From exquisitely detailed embroidery to vibrant pottery, artisans preserve ancient techniques passed down through generations. The local cuisine dazzles with flavors of falafel, hearty maqluba, and sweet baklava, reflecting a tapestry of tastes shaped by centuries of heritage and resilience.

Alice and Bob are given three integers x, y, and z. They need to calculate the sum of these integers and determine the winner. If the sum is even, print "Alice". If the sum is odd, print "Bob".

Input

One line contains three numbers x, y, and z ($1 \leq x, y, z \leq 100$).

Output

Print "Alice" if the sum of the integers is even, or "Bob" if the sum is odd.

Examples

standard input	standard output
1 2 3	Alice
2 2 1	Bob

Problem E. Haifa

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

Haifa's hallmark has been its multicultural and multi-ethnic fabric, where Jews, Christians, and Muslims have coexisted harmoniously, each preserving their religious and cultural traditions. This diversity permeates the city's neighborhoods, markets, and public spaces, fostering a dynamic social texture. Haifa has long been a beacon of peaceful coexistence, where different faiths flourish side by side. This enduring spirit of unity amidst diversity continues to define Haifa, making it not merely a city of historical grandeur and natural beauty, but a living testament to the possibility of harmony in the midst of cultural differences.

Given an integer p, count the number of different convex quadrilaterals such that they have integer sides and perimeter p. Since the answer might be too large, print it modulo $10^9 + 7$. Two quadrilaterals are considered the same if one can be obtained from the other by a rotation and a translation.

Formally, we want to count the number of (a, b, c, d) such that:

- $a, b, c, d > 0$

- $a + b + c + d = p$

- a, b, c, d form sides of convex polygon in clockwise direction.

- (a, b, c, d) is considered the same as (b, c, d, a) (rotations).

Input

First line contains one integer $t(1 \le t \le 4 \cdot 10^5)$ the number of test cases.

Second line contains one integer $p\,(4 \le p \le 10^9)$

Output

print the number of different Convex Quadrilaterals.

Example

standard input	standard output
5	1
4	1
5	2
6	4
7	568
32	

Problem F. Yafa

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

Forget amber waves of grain, think golden seas of citrus! By the late 1800s, Yafa wasn't just a port city, it was a citrus paradise! Imagine the fragrant air as orange and grapefruit groves stretched for miles around the city. This golden age of citrus transformed Yafa into a major exporter. Ships filled with Yafa oranges lined the port, carrying the city's taste across the globe. Yafa became synonymous with delicious citrus, a trademark that put the city on the map and fueled its prosperity for decades.

Youssef, a student in a data structure course, found himself stuck in an exam question that required more context than was provided. To tackle the problem, he decided to convert it into an interactive problem.

The problem is as follows: you are given a graph with $n = 2000$ nodes and exactly one directed edge from node a to node b. Your task is to find the nodes a and b respectively.

In order to find the edge, you can ask a query in which you divide the nodes into three sets (S_1, S_2 and S_3), and you obtain information about where the edge is between the three sets. Each node must be present in exactly one set and exactly one of the sets can be empty.

You can ask at most 7 queries, **not including your guess**.

Refer to the interaction protocol on how to ask queries and answer.

Interaction Protocol

You can start the interaction by asking a query.

The query should be structured in 5 lines:

1. The first line is "?".

2. The second line is a single integer m_1 ($1 \le m_1 < n$) representing the size of the first set.

3. The third line contains m_1 integers, which are the nodes of the first set.

4. The fourth line is a single integer m_2 ($1 \le m_2 < n$) and ($m_1 + m_2 \le n$) representing the size of the second set.

5. The fifth line contains m_2 integers, which are the nodes of the second set.

The third set will consist of the remaining $n - m_1 - m_2$ nodes (you do not need to print these).

Next, read two integers x and y ($1 \le x, y \le 3$), indicating the edge going from set S_x to set S_y.

Finally, once you determine the answer, print the edge on one line in the format:

$$! \ a \ b$$

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
1 2 1 3 3 2	? 2 1 2 2 3 4 ? 2 1 2 1 4 ? 1 1 1 3 ! 2 3

Problem G. Jinin

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

 Jenin, a city that whispers the tales of ancient times, located amidst rolling hills and verdant valleys, Jenin's landscape serves as a cradle for centuries-old olive groves, whispering tales of resilience and abundance. From these ancient groves springs forth Palestinian olive oil, a liquid gold renowned for its unparalleled quality and distinctive flavor. The timeless art of olive oil production, steeped in tradition and passed down through generations, transforms the harvesting and pressing of olives into cherished cultural festivities, uniting families and communities in celebration.

In the year 3024, a computer scientist is working on a new kind of data structure, the k-array, to handle the massive amounts of data in the quantum computing era. The scientist needs your help to understand the potential of this new data structure.

Given three integers n, k, and a, your task is to determine the number of ways to generate a k-array of size i for each i ($1 \le i \le n$).

An array is called a k-array if the following conditions hold:

- The array contains only positive integers.

- The maximum value that can be in the array is a.

- The occurrences of each element in that array don't exceed k.

Can you help the scientist?

Input

The input consists of three integers n, k, and a ($1 \le n, k \le 10^5, 1 \le a \le 10^9$).

Output

The output should be a sequence of n integers, where the i-th integer is the number of ways to generate a k-array of size i. Since the answer can be very large, output it modulo 998244353.

Examples

standard input	standard output
3 1 3	3 6 6
5 2 3	3 9 24 54 90

Problem H. Al Ramla

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

Who needs magic lamps? Al-Ramla rose from the desert sands in 716 CE! The Umayyad Caliphate transformed this dusty stop for camel caravans into Palestine's booming capital. Enter Zahra, a weaver famed for her intricate tapestries. Al-Ramla's reliable water, thanks to a grand aqueduct, allowed Zahra and countless artisans to flourish. Their skills, along with a bustling marketplace, made Al-Ramla an economic powerhouse. This prosperity, fueled by the Caliphate's investment, became Al-Ramla's most important trademark.

Youssef, a curious (and sometimes mischievous!) third-grader, is learning how to tell time on a wall clock. In a playful prank, he swaps the positions of the hour hand (H) and minute hand (M). Now, the clock displays a strange time!
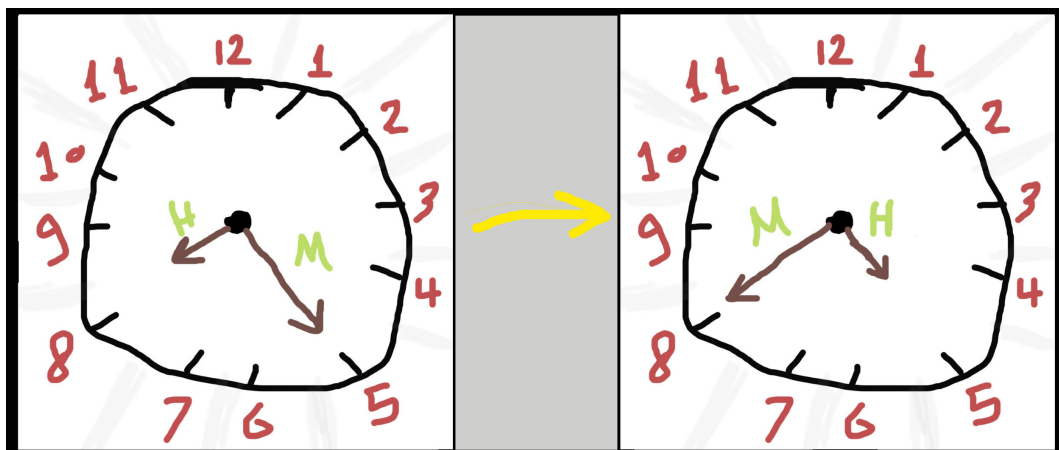
Swapped positions of hands to make the clock show 5:40 from 8:25.

He freaked out and doesn't know what to do. Can you help her set the clock to the correct time?

To make it more simple the hands only points to integer numbers.

Input

The first line contains a single integer t ($1 \le t \le 12$) — the number of test cases.

The only line of each test case contains the time in the format $HH : MM$ ($1 \le HH \le 12$) ($0 \le MM \le 55$).

It is guaranteed that MM is divisible by 5 (since the clock hand only points to a real number).

Output

For each test case, print a single line, the real time before swapping in the format $HH : MM$ ($1 \le HH \le 12$) ($0 \le MM \le 55$).

Example

standard input	standard output
3	08:25
05:40	04:55
11:20	07:40
08:35	

Problem I. Tulkarm

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

In the fields of Tulkarm, Malik, and Sara played joyfully among the sunlit vineyards and orange groves, their laughter mixing with the scent of ripe fruit. Inspired by Tulkarm's famous grapes and citrus orchards, they imagined themselves as explorers discovering the finest treasures of the land. Each fruit they picked connected them to the heart of their beloved city, Tulkarm, reminding them of its rich heritage and the blessings of its fertile soil.

Shahd denotes the *beauty* of an array b of length k as follows :

$$\sum_{i=1}^{k} c_i$$

Such that :

- $c_1 = b_1$

- $c_i = min(c_{i-1} - 1, b_i)$ for every $2 \le i \le k$

You're given an array a of length n , Help **Shahd to calculate the maximum** *beauty* **of a subarray of the given array .**

Input

The first line contains one positive integer t $(1 \le t \le 10^5)$ — the number of test cases. Then t test cases follow.

Each test case begins with a line containing one integer n $(1 \le n \le 10^5)$ — the number of elements in the array.

The second line of each test case contains n integers $a_1, a_2, \ldots, a_n$ $(1 \le a_i \le 10^9)$.

The sum of n over all test cases does not exceed 10^5.

Output

Output the maximum *beauty* Shahd can get from all subarrays.

Example

standard input	standard output
2	15
5	21
3 9 5 1 11	
7	
3 10 2 7 9 9 3	

Problem J. Jericho - Ariha

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

Nicknamed the "City of Palms"for a reason, Jericho boasts an oasis unlike any other. It's home to the towering Tel Jericho, an archaeological marvel. "Walk these dusty paths, in the oldest city of the world,"says Jameela, a local guide, "and you're walking in the footsteps of history."Here, unearthed wonders like the remains of a 10,000-year-old settlement and a mysterious "pre-pottery Neolithic"tower whisper tales of humanity's earliest steps toward civilization.

You are given two integers x and y.

Is it possible to make x equal to y by doing the following operation any number of times:

Divide one of the numbers by one of its prime factors and multiply the other number by this prime factor.

If possible print the minimum number of operations to make them equal otherwise print -1.

Input

The first line contains a single integer t $(1 \le t \le 100)$ — the number of testcases.

Each test contains one line has x, y $(1 \le x, y \le 10^{18})$.

Output

For each test case, if possible print the minimum number of operations to make them equal otherwise print -1.

Example

standard input	standard output
3	0
5 5	-1
4 2	1
224 56	

Problem K. Al Quds

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

Al-Quds, known in English as Jerusalem, is one of the most ancient and significant cities in the world, with a history that spans over 5,000 years. Situated at the heart of the Middle East, it holds profound religious, cultural, and political significance for millions of people around the globe. For Jews, Al-Quds is home to the Western Wall, a remnant of the Second Temple and the holiest site in Judaism. For Christians, it is the city where Jesus Christ was crucified and resurrected, with the Church of the Holy Sepulchre standing as a monumental testament to these pivotal events in the Christian faith. For Muslims, Al-Quds houses the Al-Aqsa Mosque and the Dome of the Rock, which are considered the third holiest sites in Islam after Mecca and Medina.

Gohary, accompanied by his loyal woodpecker friend, is enjoying a peaceful stroll amidst the branches of a magnificent tree of n nodes each node has a worm in it. Suddenly, worms launch an attack, swarming the tree! Gohary's heart sinks as he realizes his woodpecker's beloved baby is perched on a distant node, far from the current location.

Driven by a sense of urgency and unwavering love for his feathered companion, Gohary vows to assist the woodpecker in reaching its offspring unharmed. However, the woodpecker has a limitation: it can only fend off worms with size at most k. To ensure a safe passage for the woodpecker, Gohary must strategically eliminate remaining worms along the path leading to the baby woodpecker's location.

Given q queries, you have to determine the number of worms Gohary needs to eliminate to clear a path for the woodpecker, enabling it to reach its baby as swiftly as possible.

Input

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

The first line of each test case contains two integers n and q $(1 \le n, q \le 3 \cdot 10^5)$ — nodes in the tree and the number of queries you have to answer.

The second line of each test case contains n integers. The i-th integer denotes the size of the worm of the i-th node.

It is guaranteed that the maximum size of each worm does not exceed n.

Each line of the next $n-1$ lines contains two integers u and v $(1 \le u, v \le n)$, indicating that there is an edge between node u and v in the tree. It is guaranteed that the given graph is a tree.

The next q lines contain three integers u v k $(1 \le u, v, k \le n)$ — the position of the woodpecker, the position of the baby woodpecker, and the size of the maximum worms the woodpecker can eat respectively.

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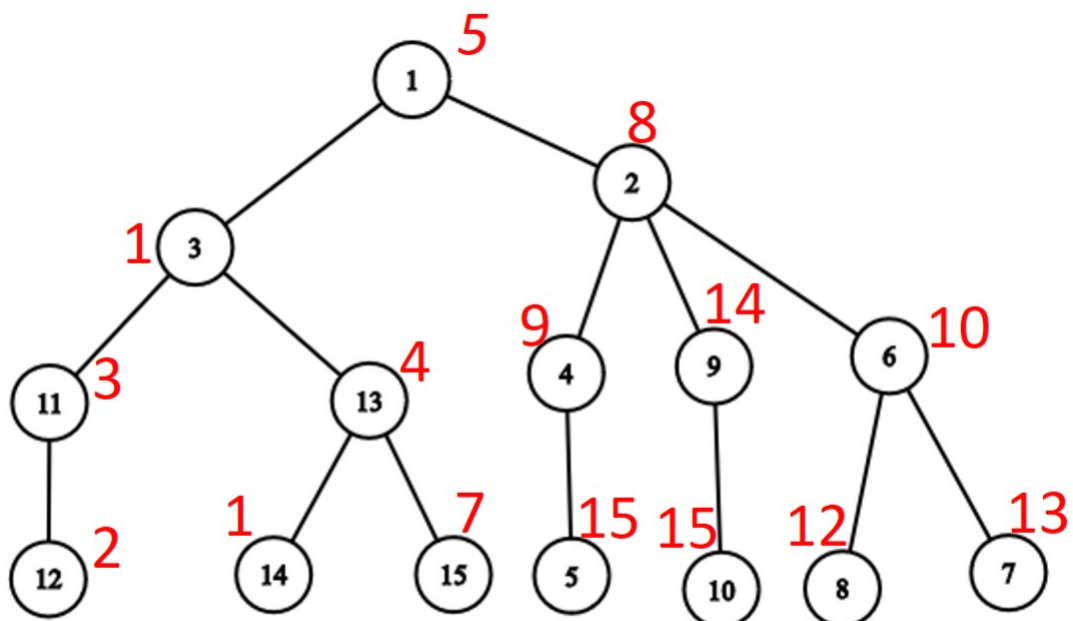
Output

For each query, print the number of worms Gohary needs to eliminate to clear a path for the woodpecker, enabling it to reach its baby as swiftly as possible.

Example

standard input	standard output
1	5
15 5	2
5 8 1 9 15 10 13 12 14 15 3 2 4 1 7	2
1 2	3
2 4	6
4 5	
2 6	
2 9	
9 10	
6 7	
6 8	
1 3	
3 11	
3 13	
11 12	
13 14	
13 15	
5 10 1	
1 14 3	
10 15 10	
7 1 7	
5 15 1	

Note

The sample test case

Problem L. Bayt Lahm

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

Bayt Lahm, the well-known, jewel south of Jerusalem, is a captivating blend of history and faith. Being Jesus Christ's birthplace, it draws Christians from around the globe. Beneath the Church of the Nativity, a silver star marks the hallowed spot. Manger Square thrums with life, the ancient church flanked by the elegant St. Catherine's and the striking Mosque of Omar, a testament to the city's religious mosaic.

You have a tree T with n nodes each node has a value a_i. The cost of the tree is the LCM of all values of the tree nodes. Your task is to find the minimum size of the subgraph of the tree such that its cost is equal to the cost of T. Note that a subgraph of a tree is a tree formed by erasing some nodes of the tree with their edges such that the remaining graph is connected. It's guaranteed that the LCM of the values of all nodes does not exceed 10^9.

Input

The first line of input contains a single integer n the number of nodes ($3 \leq n \leq 1000$).

The next line contain n space seperated integer denoting the array a ($1 \leq a_i \leq 10^9$).

The next $n - 1$ lines contain two integers u and v each denoting edges (u, v) in the tree.

Output

The minimum size of subgraph with LCM equal to the LCM of all nodes in the tree.

Examples

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

Problem M. Ramallah

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

Let me tell you a story about a beautiful city. Step back in time to Ramallah's Old City. Wander through narrow alleys lined with centuries-old Ottoman-era buildings. Admire the complex stonework and imagine the loud life of the past. Around every corner, colorful murals tell stories of history and hope, while the Khalil Sakakini Cultural Center and Al-Kasaba Theatre buzz with creativity hosting art exhibitions, cutting-edge films, and performances that reflect the city's vibrant spirit.

John and Mary participated in a marathon and recorded their finish times. You need to determine who finished the marathon faster. If John's time is less, print "John". If Mary's time is less, print "Mary". If both times are the same, print "Tie".

Input

One line contains two integers J and M, where J is John's finish time in minutes and M is Mary's finish time in minutes. ($1 \leq J, M \leq 100$)

Output

Print "John"if John finished faster, "Mary"if Mary finished faster, or "Tie"if both finished at the same time.

Example

standard input	standard output
99 95	Mary

Problem N. Akka

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

Within Akka's ancient embrace, the El-Jazzar Mosque explodes in emerald glory, a testament to a bygone era's artistry. Inside, soaring pillars echo Ottoman and Mamluk styles, and sunlight ignites stained glass, painting the floor in a mesmerizing dance of color. Every detail, from calligraphy to the perfect courtyard, whispers of a bygone era of artistry and faith. A monument that inspires awe, even centuries later.

Youssef and ZeezooX are hungry and decide to have a burger feast. They will take turns eating N burgers, each with a tastiness value A_i. Youssef starts first and eats the most tasty burger that is not eaten yet. ZeezooX, being a gentleman, eats the least tasty burger that is not eaten yet. They continue taking turns until there are no burgers left.

Your task is to find the sum of the tastiness of all burgers that Youssef eats and the sum of the tastiness of all burgers that ZeezooX eats.

Input

The input consists of:

- One line containing an integer N ($1 \leq N \leq 10^5$), the number of burgers.

- One line containing N space-separated integers $A_1, A_2, \ldots, A_N$, representing the tastiness of each burger ($1 \leq A_i \leq 10^9$).

Output

Output two integers x and y, where x is the sum of tastiness that Youssef eat and y is the sum of what ZeezooX eat

Examples

standard input	standard output
5 1 2 3 4 5	12 3
8 12 18 3 5 1 3 9 7	46 12