Problem A. A Story

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

Once upon a time in a world that looks like ours a story of a person who looks like many of us is about to begin and it unravels like a jigsaw puzzle. Make sure to open your eyes and focus, as things can look like a duplicated version of another person's story but soon you will know that it is exceptionally different than any other story you've experienced.

For it being a great harmonic and very imminent journey where paths may cross. Kudos to those who hone their knowledge and leverage their skills as marching into the future would definitely require them.

Esraa is working as an information security engineer. Every employee in her company has a password which is a permutation of N integers.

All the passwords are stored on the main server. To ensure their safety, Esraa created an encryption algorithm and named it EsraaCipher, the algorithm works in the following way:

1. The algorithm appends a 0 to the end of the permutation.
2. It generates all the rotations (left cyclic shifts) of the permutation.
3. It sorts the generated rotations in lexicographical increasing order.
4. The encrypted password is constructed by taking the last integer of every generated rotation after sorting lexicographically.

Here is an example on how the algorithm works: suppose the permutation $\mathcal{P}$ is {2, 1}, first a 0 is appended to the end of $\mathcal{P}$ so it becomes {2, 1, 0}, now the algorithm will generate all the rotations which are: {2, 1, 0}, {1, 0, 2}, {0, 2, 1}. after sorting the rotations we get: {0, 2, 1}, {1, 0, 2}, {2, 1, 0}. the encrypted password is constructed by taking the last number of every rotation after sorting, so the resulting encrypted password is {1, 2, 0}.

You are hired to try to decrypt and retrieve all the passwords. Can you write a program to decrypt all the $\mathcal{T}$ passwords (given the encrypted password, restore the original password)?

Input

The first line of input contains on integer $\mathcal{T}$ ($1 \le \mathcal{T} \le 10^5$), the number of testcases (passwords to decrypt).

The first line of every testcase contains one integer N ($1 \le N \le 10^5$), the length of the i_{th} password.

The second line of every testcase contains $N + 1$ integers separated by spaces, which represent the encrypted password.

It's guaranteed that the encrypted password contains distinct integers and any integer χ of them in the range $[0,\ N]$ ($0 \le \chi \le N$).

It's also guaranteed that the sum of lengths of all passwords won't exceed $3 \text{x} 10^5$

Output

Output $\mathcal{T}$ lines, in the i_{th} line output N integers separated by spaces which represent the i_{th} password after decryption. Note that it must be a permutation of size N.

Example

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

Note

Lexicographical order is defined in the following way. When we compare permutations s and t, first we find the leftmost position where $s_i \neq t_i$. If there is no such position (i. e. s is a prefix of t or vice versa) the shortest permutation is less. Otherwise, we compare s_i and t_i.

Problem B. Begins and it

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

Just like any story, it begins with an ambitious person, Hisham. And as it moves forward, paths start to appear and connect. And as it takes two to Tango, Endure Capital, the ACPC Community Partner, believing in the relentless execution to build and achieve hyper-growth, starts investing in Hisham's future journey.

Hisham has two integer arrays $\mathcal{A}$ and $\mathcal{B}$, both of length N. He defines the beautiful shifting operations on arrays χ of length N as doing one of two operations:

- Shift all elements to the right, i.e. the new value of χ_i is equal to the old value of χ_{i-1}, and the new value of χ_1 is equal to the old value of χ_N.
- Shift all elements to the left, i.e. the new value of χ_i is equal to the old value of χ_{i+1}, and the new value of χ_N is equal to the old value of χ_1.

Hisham calls index I beautiful if $\mathcal{B}_i$ divides $\mathcal{A}_i$, i.e. ($\mathcal{A}_i \bmod \mathcal{B}_i == 0$). Also he defines the beauty of the array $\mathcal{A}$ as the number of beautiful indices.

You can do the beautiful shifting to either $\mathcal{A}$ or $\mathcal{B}$ as many times as you want (possibly zero). What is the maximum possible beauty of Array $\mathcal{A}$?

It's guaranteed that the elements of the array $\mathcal{B}$ are distinct.

Input

The first line of input contains one integer $\mathcal{T}$ ($1 \le \mathcal{T} \le 100$), the number of testcases.

The first line of every testcase contains one integer N ($1 \le N \le 10^5$), the length of the arrays $\mathcal{A}$, $\mathcal{B}$.

The second line of every testcase contains N integers separated by spaces, which represent the array $\mathcal{A}$ ($1 \le \mathcal{A}_i \le 10^5$).

The third line of every testcase contains N integers separated by spaces, which represent the array $\mathcal{B}$ ($1 \le \mathcal{B}_i \le 10^5$), and all $\mathcal{B}_i$ are distinct.

It's guaranteed that the sum of N over all testcases won't exceed $3 \text{x} 10^5$.

Output

Output $\mathcal{T}$ lines, in the i_{th} line output one integer which represents the maximum possible beauty of arrays $\mathcal{A}$ for the i_{th} testcase.

Example

standard input	standard output
4 3 1 2 4 3 2 1 4 3 1 4 1 5 9 2 6 2 1 2 1 2 1 2 4	2 1 2 0

Problem C. Can look like a

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

A deja vu is a French word expressing the feeling that one has lived through the present situation before. It seems that this story of the passionate Hisham can look like a story written by a different self in a different universe, yet something seems to be a bit different.

Hisham is a knight who fights bad monsters. There are N monsters. Each monster has a power. Hisham needs to neutralized all of bad monsters to be the one true knight of the realm.

Hisham can neutralize the bad monsters in any order. In one operation, he can choose a monster that has a positive power, and neutralize that monster. When Hisham neutralizes a monster with power p, all the monsters' powers will decrease by p_i and you earn p points. A monster is said to be neutralized when its power reaches zero or less.

What is the maximum number of points Hisham can earn after neutralizing all the bad monsters?

Input

The first line of input contains one integer T $(1 \le T \le 2000)$, the number of testcases.

The first line of each testcase contains one integer N $(1 \le N \le 10^5)$, the number of bad monsters.

The second line of each testcase contains N integers p_i $(1 \le p_i \le 10^9)$, the power of the i_{th} monster.

It's guaranteed that the sum of N over all testcases won't exceed $3x10^5$.

Output

Output T lines, in the i_{th} line output one integer which represents the maximum number of points you can earn after killing all the monsters of the i_{th} testcase.

Example

standard input	standard output
2 4 1 3 2 2 3 10 6 2	3 10

Problem D. Duplicated version but

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

A deja vu is a French loanword expressing when one feels they have lived through the same situation in the past. It almost looked like a duplicated version and they certainly got us in the first part, but even when things look exactly similar between Kristin and Kareem, the tiniest butterfly movement can make the whole difference.

Kareem was bored so he decided to draw a tree of N vertices, rooted at vertex 1.

The next day, Ossama came and saw that Kareem's tree needed more beauty, so he decided to make each vertex v assigned with a beauty value $\mathcal{B}_v$.

The day after that, Ossama woke up and took another look at the tree and found out that it still needs some changes, but he did not know what to do, so he gave the task to you.

You will be given the final tree with assigned beauty values, you need to remove some vertices from the tree (possibly all of them) such that the resulting forest of trees has maximum possible total beauty value, but it should be satisfying 2 main conditions:

- For each pair(u, v) of the remaining vertices, it must hold that $dist(u, v)$ is even in the given tree.
- If we insert the remaining vertices in an array and sort it according to their level (depth in the given tree, then for each two adjacent vertices u, v, it must hold that: $(\text{Level}_u = \text{Level}_v)$ or $(\mathcal{L} <= | \text{Level}_u - \text{Level}_v | <= \mathcal{R})$.

Note that:

- the beauty value of a tree is equal to the sum of beauty values of all its vertices.
- the beauty value of a forest is equal to the sum of beauty values of all its trees.

Input

The first line of input contains one integer $\mathcal{T}$ $(1 \le \mathcal{T} \le 1000)$, the number of testcases.

The first line of every testcase contains three integers N, $\mathcal{L}$, $\mathcal{R}$ $(1 \le N \le 10^5)$, $(1 \le \mathcal{L} \le \mathcal{R} \le 10^9)$, the number of vertices on the tree, the $\mathcal{L}$ and $\mathcal{R}$ values on the second condition.

Then $N - 1$ lines follows. Each line contains two integers u, v $u != v$ separated by spaces, which represents the edges of the tree.

Then one line follows, which contains N integers separated by spaces, which represents the array $\mathcal{B}$ $(-10^9 \le \mathcal{B}_i \le 10^9)$.

It's guaranteed that the sum of N over all testcases won't exceed $3\text{x}10^5$.

Output

Output $\mathcal{T}$ lines, in the i_{th} line output one integer which represents the maximum possible total beauty value for the i_{th} testcase.

Example

standard input	standard output
3	6
9 1 3	0
7 3	0
1 6	
5 2	
9 7	
4 9	
8 4	
3 2	
1 8	
1 -1 2 -1 0 -1 0 2 2	
1 1 3	
-1	
9 1 3	
7 3	
1 6	
5 2	
9 7	
4 9	
8 4	
3 2	
1 8	
-3 -1 -4 -1 -5 -9 -2 -6 -5	

Problem E. Exceptionally different

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

Reading through others' lives, Yosri discovers that everything looks so familiar, yet everything is so exceptionally different. Yosri decides that for it being a great harmonic imminent journey, it is worth a little bit of a spoiler alert. But eventually, kudos to those who figure the story out. And as always Coach Academy, the ACPC Training Partner, jumps into the picture with training opportunities to provide guidance and lend a hand to Yosri through his big journey ahead.

Yosri has an array $\mathcal{A}$ of N elements. He asks you to find the number of XOR-GOOD triples (i, j, k) $(1 \le i < j < k \le N)$.

Yosri calls a triple (i, j, k) XOR-GOOD if and only if: $(\mathcal{A}_i \oplus \mathcal{A}_j \oplus \mathcal{A}_k)$ is a power of 2. where $\oplus$ represents the bitwise XOR function.

Note that, according to the Yosri, 1 **is not actually a power of 2.**

Input

Thee first line of input contains one integer T $(1 \le T \le 1000)$, the number of testcases.

The first line of every testcase contains one integer N $(3 \le N \le 2000)$, the length of the array $\mathcal{A}$.

The second line of every testcase contains N integers separated by spaces, which represent the array $\mathcal{A}$ $(1 \le \mathcal{A}_i \le 10^6)$.

It's guaranteed that the sum of N over all testcases won't exceed 2000.

Output

Output T lines, in the i_{th} line output one integer which represents the number of XOR-GOOD triples for the array $\mathcal{A}$ for the i_{th} testcase.

Example

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

Problem F. For it being a

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

It is the year 2708, and people are so excited about the newest inventions. Who could imagine that after so many years we are finally here gathering onsite for the annual Earth Collegiate Programming Championship (ECPC). It is the new era of ECPC. For it being so full of potentials the ECPC family can't wait to pursue their goals and future plans, but first they encourage everyone to enjoy the moment.

It's been 1200 years since the beginning. With the advancement of technology, the Grey Time Operation team is having a journey inviting prodigies from the past. But of course they need to identify which era each team member is heading to.

The Grey team knows that:

- 1508 was the new era for "**pocket watches**".
- 1608 was the new era for "**telescopes**".
- 1708 was the new era for "**steam engines**".
- 1808 was the new era for "**telephones**".
- 1908 was the new era for "**airplanes**".
- 2008 was the new era for "**terraforming**".
- 2108 was the new era for "**exploration**".
- 2208 was the new era for "**relaxing**".
- 2308 was the new era for "**going above and beyond**".
- 2408 was the new era for "**second chances**".
- 2508 was the new era for "**the origin**".
- 2608 was the new era for "**empowering the youth**".
- 2708 was the new era for "**ECPC**".

Now, before you begin your celebration with the new Era, we need to make sure that history is well documented. We will ask you about a year from the above list of years, and you need to tell us which era was it. See the examples for more clarity.

Input

You will be given only one integer number Y.

$Y \in \{1508, 1608, 1708, 1808, 1908, 2008, 2108, 2208, 2308, 2408, 2508, 2608, 2708\}$.

Output

Print what is the era of year Y is famous for.

Examples

standard input	standard output
2708	ECPC
2308	going above and beyond
2608	empowering the youth