The International Collegiate Programming Contest
Sponsored by ICPC Foundation

The 2024 Angolan Collegiate Programming Contest

(Contest Problems)

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Luanda
October 2024

Problem A. Wu-Tang and Monsters

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

Wu-Tang is a highly skilled kung fu player capable of using his head, legs, or arms in combat. One day, he found himself trapped in a cave filled with monsters that he must defeat in a specific order. Each monster has a strength denoted as s_i, and Wu-Tang can choose to attack using one of three methods: head, legs, or arms, which inflict h, l, and a damage, respectively.

However, Wu-Tang must follow a strict rule: for each monster, he can choose only one method to attack, but he cannot use the same method consecutively for the next monster. This means if he defeats a monster using his head, the next monster cannot be attacked with his head again, but must be attacked with either his legs or arms.

The objective is for Wu-Tang to defeat all the monsters in the **minimum** number of hits while adhering to this rule.

Input

The first line of the input contains four integers n, h, l, a ($1 \leq n \leq 10^5, 1 \leq h, l, a \leq 10^9$) — the number of monsters, the amount of damage for head, leg, arm, respectively.

the second line of the input contains n integers $s_1, s_2, ...s_n$ ($1 \leq s_i \leq 10^9$) — the strength for each monster.

Output

Output a single integer, the **minimum** number of operations to defeat all monsters.

Example

standard input	standard output
10 9 8 6 1 2 3 4 5 6 7 7 7 7	10

Problem B. WahWah And Ranges

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

In the land of Hadaba, there lived a renowned mathematician named WahWah, whose passion for prime numbers and range-based problems was unrivaled. His friend Gamal, however, had grown weary and frustrated with these endless challenges. Exasperated, Gamal urged WahWah to stop with the range problems once and for all.

But WahWah, ever the strategist, proposed a deal: if Gamal could solve one last problem, WahWah would cease creating range-based puzzles. The problem is as follows:

Given an array of size n, and q queries, each query contains three indices l, r, x.

You need to determine how many times the greatest prime factor that occurs exactly once in a_x appears as a prime factor in the elements $[a_l, a_{l+1}, \ldots, a_r]$.

For example, if $a_x = 75$, the prime factorization of 75 is $3 \times 5 \times 5$, and the greatest prime factor that occurs only once in a_x is 3.

If a prime factor occurs more than once in a number within the range, its frequency is counted accordingly. For instance, if 3 appears three times in one number, it is counted three times.

Gamal has just woken up and is feeling too lazy to solve it. Can you help him, so WahWah will finally stop?

Input

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

The first line of each test case contains 2 integers n, q ($1 \leq n, q \leq 10^5$) – the length of the array and the number of queries.

The second line of each test case consists of n integers a_i ($1 \leq a_i \leq 10^9$) — array a.

The next q lines of each test case consist of 3 integers l, r, x ($1 \leq l \leq r \leq n, 1 \leq x \leq n$).

It is guaranteed that the sum of n over all test cases doesn't exceed 10^5, and the sum of q doesn't exceed 10^5.

Output

For each query, output a single integer g, representing how many times the greatest prime factor that occurs exactly once in a_x appears as a prime factor in the elements from index l to r. If a_x has no such prime factor, output -1.

Example

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

Problem C. Sherlock and Palindromes

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

One day, Sherlock and Watson were sitting next to the fire and talking. Sherlock was telling Waston how much he likes palindromes and that he wants everything in this world to be a palindrome.

A palindrome is a string that reads the same way backward as forward; for example, strings **1**, **111** and **101** are palindromes, but strings **110** and **10** are not.

Watson asked Sherlock if he could form a palindrome from some zeros and ones. Sherlock solved this problem in no time. He asked Watson if he could tell him the second lexicographically smallest palindrome that can be formed.

A string a is lexicographically smaller than a string b if, in the first position where a and b differ, the string a has a letter that appears earlier in the alphabet than the corresponding letter in b.

Input

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

The first and only line of each test case contains two integers a and b ($0 \leq a, b \leq 10^5$) — the number of zeros and ones respectively.

It's guaranteed that for each test case $a + b \geq 1$.

It's guaranteed that the sum of $a + b$ over all test cases doesn't exceed $4 \cdot 10^5$.

Output

For each test case, print second lexicographically smallest palindrome that can be formed or -1 if there is no such palindrome.

Example

standard input	standard output
4 2 2 7 3 6 3 3 3	1001 -1 001010100 -1

Problem D. Rady Boxing

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

Rady always fought Beshoy using his bare hands in a boxing match. He always won and now Beshoy is fed of it and wanted to get his long-awaited revenge. He wants to settle it through a challenge as he can't beat Rady in a boxing match. He gave Rady an array of n integers and lets him do one kind of operation.

The operation is to raise all elements to the power $x \cdot m$, where m is any positive integer. You are required to find the minimum x greater than 1 that makes all the array elements equal. If it is not possible to make the array elements equal, output -1.

Note: m can be different for each element, but x is the same for all elements.

Input

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

The first line of each test case contains integer n ($1 \leq n \leq 10^5$) – the length of the array.

The second line contains n integers $a_1, a_2, a_3, ..., a_n$ ($1 \leq a_i \leq 10^9$) — array a.

It is guaranteed that the sum of n for all test cases does not exceed $2 \cdot 10^5$

Output

For each test case, output one integer — the minimum x required, or -1 if it is not possible.

Examples

standard input	standard output
1 5 1 7 9 5 3	-1
1 3 2 4 4	2

Problem E. Code of Duty

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

Code of Duty is an exciting video game that involves battling rounds against big monsters. Your friends Ali and Nego are both avid gamers, and Nego has invited Ali to try this game out. In each round, Ali will face a monster with a specific number n, and he must defeat it using a gun. However, Ali can only use a limited number of bullets, so he needs to be strategic about how many he takes.

To succeed in defeating the monster, Nego has given Ali a helpful tip: he needs to shoot the monster with a prime number that has the number of digits as the monster's number.

Ali is not a math expert, so he needs your help to figure out the minimum number of bullets he needs to defeat each monster and progress to the next round. Can you help him out and ensure he emerges victorious in each round?

Input

The first line contains t ($1 \leq t \leq 10^6$). the number of rounds

The next t lines contain a number n ($1 \leq n \leq 8$).

Output

print t lines each line has the smallest number of bullets Ali needs to defeat the monster and go to the next round

Example

standard input	standard output
2 1 3	2 101

Problem F. Rotate It

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

You are given an integer n. Consider the binary representation of this number without leading zeroes. You can rotate the binary representation of this number by moving its bits to the left end, where the leftmost bit moves to the rightmost position.

Your task is to find the maximum integer you can obtain after performing any number of rotations on the binary representation, without adding any leading zeroes.

Input

The first line contains the number of test cases t ($1 \leq t \leq 10^5$).

Each test case contains one integer n ($1 \leq n \leq 10^9$).

Output

Output a single integer, the **maximum** integer you can obtain after performing any number of rotations.

Example

standard input	standard output
5 7 11 12 3 17	7 14 12 3 24

Note

For instance, consider the integer $n = 11$. The binary representation of 11 is 1011.

- Rotating the bits to the left, we get:
  - 1011 (original)
  - 0111 (rotate left once)
  - 1110 (rotate left twice)
  - 1101 (rotate left thrice)

The maximum integer obtainable after any number of rotations is 14 (binary 1110).

Problem G. Amin's Campaign

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

The elections for the new mayor of Ducks City are approaching, and Amin, the current mayor, will do anything to keep his position. As the mayor, Amin has access to lots of information about Ducks City and he has decided to use it to his advantage.

Amin knows that for each poster he puts on a lighting pole, he gets one vote guaranteed. Ducks City has n poles.

The cost of putting one poster on a pole equals $h_i + x * k$. h_i is the height of the pole and k is the number of posters already on the pole.

Amin knows that he needs m votes to win the elections.

Although Amin became filthy rich from being the mayor, he still wants to save money. He has decided to ask for your help. Help him by calculating the minimum cost that will make him win the elections.

Input

The first line of each test has one integer T $(1 \leq T \leq 10^5)$ − The number of test cases.

The first line of each testcase has three integers n, m, and x $(1 \leq n, m \leq 10^5)$ $(1 \leq x \leq 10^9)$ − The number of poles in Ducks City, the required number of votes, and the integer x.

The second line of each testcase has n integers h_i $(1 \leq h_i \leq 10^9)$ − The height of the light poles.

The summation of n and m over all testcases doesn't exceed 10^5.

Output

A single integer − the minimum cost that guarantees that Amin wins the elections.

Example

standard input	standard output
1 4 8 2 2 4 6 8	44

Problem H. Rady and His Arms

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

Sometimes, Rady ponders the idea of walking on his arms instead of his legs, speculating that if he can stand on his arms, he can walk on them too.

You will be provided with two numbers: l_1 representing his current arm length, and l_2 representing the distance from his shoulders to the ground. Rady can train and extend his arm's length. Your task is to find the **minimum** arm length required for Rady to walk on his arms. He can walk on his arms if the length of his arms is greater than the distance from his shoulders to the ground.

Input

The first line contains the number of test cases t ($1 \leq t \leq 10^5$).

Each test case contains two integers l_1 and l_2 ($1 \leq l_1 \leq l_2 \leq 10^9$).

Output

Output a single integer, the **minimum** arm length for Rady to make him able to walk on his arms.

Example

standard input	standard output
5 7 11 2 4 223 453 12 19 20 20	12 5 454 20 21

Problem I. Tree MEX Queries

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

Given a tree of n nodes, each node has a value written on it. The tree is rooted at node 1.

The values written on the nodes form a permutation that contains all integers from 1 to n exactly once.

We define the **MEX** of the subtree of u, as the minimum **positive** integer that is not written on any node in its subtree.

You have to process q queries of two types:

- 1 l r: Swap the values written on the nodes l and r.
- 2 u: Find the **MEX** of the subtree of u.

For each query of the second type, print a new line containing its answer.

Input

The first line of the input contains two integers n and q ($1 \leq n, q \leq 10^6$), representing the size of the tree and the number of queries.

The second line of the input contains n space separated integers $a_1, a_2, ..., a_n$ ($1 \leq a_i \leq n$), representing the values written on the nodes. It's guaranteed that the values form a permutation.

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

The following q lines contain the queries in one of the following forms:

- 1 l r ($1 \leq l < r \leq n$).
- 2 u ($1 \leq u \leq n$).

It's guaranteed that there is at least one query of the second type.

Output

For each query of the second type, print a new line containing its answer.

Example

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

Problem J. Nablus

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

Nablus: A City That Speaks in Flavors 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.

Saba7 and Wa7eed are playing a game. Initially, they are given two non-empty strings s and t of length n and m, consisting of lowercase Latin letters. They also have an empty string x.

Saba7 starts, then they alternate moves. In one move, a player takes either the first or the last letter of s, removes it from s, and adds it to the end of x.

Saba7 wins if at the end x contains t as a substring; otherwise, Wa7eed wins.

Your task is to determine the winner of the game if both players play optimally.

Input

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

The first line of each test case contains two integers n, m ($1 \le n \le 1000$), ($1 \le m \le 100$) — the length of the string s, the length of the string t respectively.

The second line of each test case contains the string s.

The third line of each test case contains the string t.

It is guaranteed that the sum of n over all test cases does not exceed 1000, and the sum of m over all test cases does not exceed 100.

Output

Output "Saba7"without quotes if Saba7 will win or "Wa7eed"without quotes if Wa7eed will win.

Example

standard input	standard output
1 4 2 aabb ab	Saba7

Problem K. Game

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

In a simple number game, two players each choose a number. The player with the smaller number loses the game. If both players choose the same number, the game ends in a draw. Your task is to determine the outcome: who loses the game, or if it's a draw.

Input

The first line contains an integer a ($1 \leq a \leq 1000$), representing the number chosen by the first player.

The second line contains an integer b ($1 \leq b \leq 1000$), representing the number chosen by the second player.

Output

Output a single line with one of the following:

- `"p1"` if the first player loses,
- `"p2"` if the second player loses,
- `"d"` if the game is a draw.

Examples

standard input	standard output
1 3	p1
9 9	d

Problem L. Nablus Nostalgia

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

Nestled in the hills, the city of Nablus is a treasure trove of historical and cultural riches. Famous for its bustling old market and the traditional soap-making industry, Nablus also boasts the stunning Ottoman-era architecture that gives the city its unique character. However, the city's charm is often marred by the lingering effects of conflict and economic struggles.

Jack is organizing his schedule and needs to determine if the day of the month he picks is for work or rest. He considers even-numbered days as workdays and odd-numbered days as rest days.

Help Jack by writing a program that determines if a given day number is a workday or a rest day.

Input

A single integer d representing the day of the month (1 to 31).

Output

Print "Work"if the day is a workday.

Print "Rest"if the day is a rest day.

Examples

standard input	standard output
3	Rest
1	Rest

Note

The answer is case sensetive.