Father Timm Memorial Programming Contest 4.0 - Practice Contest

https://toph.co/c/father-timm-memorial-4-0-preliminary-mock

Toph

Schedule

The contest will run for **4h0m0s**.

Rules

You can use Bash 5.2, Brainf*ck, C# Mono 6.0, C++17 GCC 13.2, C++20 Clang 16.0, C++20 GCC 13.2, C++23 GCC 13.2, C11 GCC 13.2, C17 GCC 13.2, C23 GCC 13.2, Common Lisp SBCL 2.0, D8 11.8, Erlang 22.3, Free Pascal 3.0, Go 1.22, Grep 3.7, Haskell 8.6, Java 1.8, Kotlin 1.1, Lua 5.4, Node.js 10.16, Perl 5.30, PHP 8.3, PyPy 7.1 (3.6), Python 3.12, Ruby 3.2, Rust 1.57, Swift 5.3, and Whitespace in this contest.

Be fair, be honest. Plagiarism will result in disqualification. Judges' decisions will be final.

Notes

There are 7 challenges in this contest.

Please make sure this booklet contains all of the pages.

If you find any discrepencies between the printed copy and the problem statements in Toph Arena, please rely on the later.

A. Cat Everywhere

Cats everywhere! I came back home after being far away for a long time.

Two of my sisters are very fond of cats. So many cats stay at our home. My sisters give them a different name (Kitty, Puffy, Neffy, Toffy, Kiffy, Soffy, Kulffy, Wolffy, Borffy). Here Kitty is the oldest cat, then Puffy and so on. Borffy is the youngest cat. Every time my sisters tell me about their name and age, I instantly forget them.

It's too confusing to me. So I came up with a plan that I will name them by number $(1, 2, 3 \ldots)$. But seeing those cats' names I find out one thing. My sisters love "ffy" at the end of a cat's name. So I will name them like this (1ffy, 2ffy, 3ffy, 4ffy, ...) oldest to youngest.

Now if anyone asks me, "Who is the 3rd oldest cat?". I can instantly say "3ffy". Did you get my idea?

In this problem, I will give you the name of n^{th} oldest cat. You have to say me the name of $(n+1)^{th}$ oldest cat (so that I can be sure that you understood my idea of cat's naming)

Input

You will be given the name(of the n^{th} oldest cat), s ($4 \leq \text{length of s} \leq 21$) in a single line.

Output

You have to print the name of $(n+1)^{th}$ cat.

Samples

<u>Input</u>	<u>Output</u>
`5ffy`	`6ffy`
`5ffy` is the name of the `$5^{th}$` cat. So name of the `$6^{th}$` cat will be `6ffy`	

B. I Dont Like Polynomial

Given a k degree polynomial $P(x) = \sum_{i=0}^{k} a_i x^i$ $(0 \leq a_i \leq 7)$ and $f(n) =$ "number of such polynomial so that $P(2) = n$", find $\sum_{i=0}^{m} f(i)$ for a given number m.

I found this problem in an online contest. But it was very tough for me to solve. Luckily I found a solution pattern for this problem generating solution for some small test cases. I found that:

$$f(n) = \lfloor \frac{\lfloor \frac{n+4}{2} \rfloor^2}{4} \rfloor$$

But still, I can't find $\sum_{i=0}^{m} f(i)$. So please help me out.

Input

The first line contains a single integer t $(1 \leq t \leq 10^5)$ number of test cases. On next line there are t numbers, $m_i (0 \leq m \leq 10^{18})$ meaning that in case i you should solve for number m_i.

Output

For each test case i, print the answer modulo $10^9 + 7$ on separate lines.

Samples

Input	Output
4 1 2 3 4	2 4 6 10

for the second test case :

`$f(0)=1$` because there is only one polynomial for which `$P(2)=0$` and the polynomial is `$P(x)=0\times x^0$`

`$f(1)=1$` because there is only one polynomial for which `$P(2)=1$` and the polynomial is `$P(x)=1\times x^0$`

<u>Input</u>	<u>Output</u>
$f(2)=2$ because there is two such polynomial for which $P(2)=2$ and the polynomials are $P(x)=2\times x^0$ and $P(x)=0\times x^0+1\times x^1$ Hence $\sum_{i=0}^{2}{f(i)}=1+1+2=\boxed{4}$	

Here $\sum_{i=j}^{k} f(i)$ means $f(j)+f(j+1)+f(j+2)+...+f(k-1)+f(k)$. $\lfloor x \rfloor$ means “largest integer which is smaller than or equal to x".

C. Square Maze

Sajib is a criminal. Respected judge has sentenced him to prison for 10 years! He is now spending his lazy time in prison.

You are also trapped inside the prison with Sajib. Bored Sajib started playing with a rectangular grid of dimension $N * M$ where each element can be either an integer between 0 or 1. Sajib wants to find out the maximal area of a square consisting of only 1's from the rectangular grid. But there is a catch!

There are some special cells in the grid. Sajib knows there are exactly K of them in the rectangular grid. He knows their positions as well. One can toggle the value of such cells from 0 to 1 or from 1 to 0 if they want, as many times as they wish! The cost of toggling i_{th} special cell is given by C_i.

As Sajib is not a programmer (and you are), can you help him find out the maximal area of a square consisting of only 1's with minimum cost of toggling?

Input

The first line of the input contains an integer T ($1 \leq T \leq 7$), number of test cases.

The second line of each input contains three integers N, M ($1 \leq N, M, C \leq 1000$), and K ($0 \leq K \leq min(N \times M, 10^4)$) denoting the number of rows, columns, and special cells respectively.

In the next N lines, there will be M space-separated integers.

After that, there will be K lines for each test case. In each line, there will be three integers denoting the position (row and column) of the special cells and the C_i ($1 \leq C_i \leq 1000$) cost of toggling the cell. All the indices will be 0-based.

Output

Print the desired maximal area and the minimum cost (space-separated) in a single line for each test case.

Samples

Input	Output
1 3 3 0	4 0

Input	Output
0 1 0 0 1 1 1 1 1	

Large data set. Use faster I/O.

If there are multiple maximal squares satisfying all the conditions, you need to choose the one with minimum cost.

D. Survivor Sum

Suppose you have a multiset of numbers $\{a_1, a_2, \ldots, a_k\}$. Suppose x is the smallest number and y is the largest number in the set. In each move, you can remove x and y from the set and add $2xy - x - y + 1$ instead. So in each step, size of the set decreases by one. After $k - 1$ moves are performed, you have only one number remaining in the set. Let's call this number survivor of the set.

The value of a set is defined as the sum of survivors of all non-empty subsets of it.

In this problem, you have an array $b_1, b_2, b_3, \ldots, b_n$ where $1 \leq n \leq 10^5$ and $1 \leq b_i \leq 10^9$. You have answer $q \, (1 \leq q \leq 10^5)$ queries of this format: given l and r, what is the value of the set containing $\{b_l, b_{l+1}, b_{l+2}, \ldots, b_r\}$? Since the value can be extremely large, output the answer modulo $10^9 + 7$.

Input

First line contains the value of n ($1 \leq n \leq 100000$).

Second line contains n integers. i-th integer of this line represents the value of b_i.

Third line contains the value of q ($1 \leq q \leq 100000$).

Next q lines contain two integers l and r, representing the parameters of the query.

Output

Output q lines: i-th line contains the answer for the i-th query.

Samples

Input	Output
5 3 4 1 5 6 3 1 5 1 1 3 4	5775 3 11

In the third query, the set is $\{1, 5\}$. So the subsets are $\{1\}$, $\{5\}$ and $\{1, 5\}$. The survivors are 1, 5 and 5 respectively, which adds up to 11.

The difference between a set and a multiset is that unlike set, multiset can contain same element more than once. For sake of clarity, every mention of a set indigates a multiset in this problem.

E. Such an Odd Product

On his way home after a hectic day full of lab works, Tim found a sequence $a_1, a_2, \ldots, a_n$ of positive integers on the overbridge beside NDC. He is a huge fan of odd products, so he decided to make the product of all these integers odd. In order to do that, Tim can make multiple moves of the following kind: choose a position in the array and add the number in that position to one of its adjacent positions.

Formally, in a move Tim can choose two indices $1 \leq i, j \leq n$ satisfying $|i - j| = 1$ (the indices are adjacent) and add a_i to a_j.

Tim is tired, so he wants to know the minimum number of moves he has to make such that the product of all the numbers becomes odd. Can you help him?

Input

The first line contains an integer t $(1 \leq t \leq 100)$ denoting the number of test cases.

Each test case consists of two lines. The first line contains the integer n $(1 \leq n \leq 100)$ denoting the number of elements in the sequence. The next line contains n space separated integers $a_1, a_2, \ldots, a_n$ where $1 \leq a_i \leq 100$ for each valid i.

Output

For each test case, print the minimum number of moves required on a single line. If is not at all possible to make the product odd, print -1 instead.

Samples

Input	Output
4 4 1 2 2 1 2 4 6 3 1 1 1 10 4 7 8 6 4 6 7 3 10 2	2 -1 0 7

In the first case, we can add a_1 to a_2 and add a_4 to a_3. Then the sequence becomes $[1, 3, 3, 1]$ whose product is 9, an odd number. We can show that it is not possible to make fewer than 2 moves.

Input	Output
In the second case, no matter which one we add to the other, the product will not be odd. So we print -1. In the third case, the product is already an odd number 1, so we need zero moves.	

F. Diligite Lumen Sapientiae

In the heart of Dhaka, Bangladesh, during the post-independence era in 1949, a group of dedicated Roman Catholic Priests from the Congregation of Holy Cross recognized a pressing need for quality education. The newly independent country was grappling with an educational crisis. With a vision to uplift the educational sector and provide a beacon of knowledge, they embarked on a noble mission to establish a college.Amidst the bustling streets of Old Dhaka, these priests laid the foundation of Notre Dame College, naming it after the French words "Our Lady," a tribute to Mary, the mother of Jesus Christ. The initial days were tumultuous, as the college struggled with limited resources and faced numerous challenges in the nascent educational landscape.Despite the hurdles, the faculty and students remained undeterred, fuelled by their unwavering determination and a shared vision. Their collective efforts and dedication soon bore fruit, propelling Notre Dame College to prominence as one of the most esteemed educational institutions in Bangladesh.Over the years, Notre Dame College became synonymous with academic excellence, fostering a strong commitment to social justice and embracing a diverse student body. It became a melting pot of ideas, cultures, and aspirations, shaping the minds of future leaders.

The college's journey was marked by significant milestones. In 1954-55, Notre Dame College found its permanent home in Arambagh, Motijheel, symbolizing stability and growth. With time, it not only excelled in academic realms but also became a catalyst for social and economic development in Bangladesh. As the years passed, Notre Dame College stood tall, producing remarkable alumni who ventured into politics, science, arts, business, and various other fields, contributing significantly to the nation's progress.

The celebration of Notre Dame College's founding anniversary on November 3rd each year became a cherished tradition, serving as a moment of reflection on the institution's rich history and an opportunity to renew the commitment to sustain the legacy of excellence.

As today marks the 75th anniversary, Darwan Mama has tasked you with a programmatic assignment. Your mission is to create a program that, upon execution, displays a message **“This year, the college is celebrating its 75th birthday. Happy birthday, Notre Dame College.“** on the digital board near the main gate.

Input

No Input for this problem

Output

You have to print the text which Darwan mama told you to print.

G. Linear Programming?

Given the value a, b and N. Find the number of non-negative integer pairs (x_1, x_2) which satisfies the following inequality.

$$a \times x_1 + b \times x_2 \leq N$$

Input

First line contains an integer T $(1 \leq T \leq 10^4)$ denoting the number of test cases.

Each test case contains three integers N, a and b.

Subtask 1 (**10** Points): $1 \leq N \leq 10^4$, $2 \leq a \leq 1000$

Subtask 2 (**30** Points): $1 \leq N \leq 10^9$, $a = 2$

Subtask 3 (**60** Points): $1 \leq N \leq 10^9$, $2 \leq a \leq 1000$

For all subtasks $1 \leq b \leq N$.

Output

For each test print the answer in a single line.

Samples

Input	Output
2 5 2 3 10 4 1	5 21

The first inequality is $2x_1 + 3x_2 \leq 5$.

The following 5 pairs of (x_1, x_2) satisfies it.

$(0, 0), (0, 1), (1, 0), (1, 1), (2, 0)$.