Problem A. Road To The 3rd Building

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Because of the thriller adventure game *The 3rd Building*, there are fewer and fewer students who would like to go to the 3rd Building. So few students are working in the studio in the 3rd Building. Students are even more reluctant to go to the 3rd Building for experiments, which are also annoying.

Kanade takes responsibility to improve this status. She thinks it a good idea to decorate the ginkgo trees along the road to the 3rd Building, making them cute. There are n ginkgo trees that are planted along the road, numbered with $1 \dots n$. Each tree has a cute value. The cute value of tree i is s_i.

Kanade defines a **plan** as an ordered pair (i, j), here $1 \le i \le j \le n$. It means a student will appear at the position of the tree i magically, walk along the road, and finally stop walking at the position of the tree j. The **cute level** of a plan is the average of the cute value of the trees visited. Formally, the cute level of plan (i, j) is $\frac{1}{j-i+1} \sum_{k=i}^{j} s_k$.

Kanade wants to know the mathematical expectation of the cute level if a student will take a plan among all these plans in a uniformly random way. But she is busy with learning Computer Networking, would you help her?

Input

The first line of the input contains an integer T — the number of testcases. You should process these testcases independently.

The first line of each testcase contains an integer n — the number of ginkgo trees.

The second line of each testcase contains n integers s_i — the cute value of each ginkgo tree, space-separated.

$1 \le T \le 20, 1 \le n \le 2 \times 10^5, 1 \le s_i \le 10^9$

It is guaranteed that $\sum n \le 10^6$.

Output

For each testcase, output the answer in the fraction form modulo $10^9 + 7$ in one line. That is, if the answer is $\frac{P}{Q}$, you should output $P \cdot Q^{-1} \bmod (10^9 + 7)$, where Q^{-1} denotes the multiplicative inverse of Q modulo $10^9 + 7$.

Example

standard input	standard output
3 3 1 3 2 6 1 1 4 5 1 4 9 7325 516 56940 120670 16272 15007 337527 333184 742294	83333336 188888893 303405448

Problem B. Little Rabbit's Equation

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	64 megabytes

Little Rabbit is interested in radix. In a positional numeral system, the radix is the number of unique digits, including the digit 0, used to represent numbers. For example, for the decimal system (the most common system in use today) the radix is ten, because it uses the ten digits from 0 to 9. Generally, in a system with radix b ($b > 1$), a string of digits $d_1 \dots d_n$ denotes the number $d_1 b^{n-1} + d_2 b^{n-2} + \cdots + d_n b^0$, where $0 \le d_i < b$.

Little Rabbit casually writes down an equation. He wonders which radix this equation fits.

Input

The are several test cases. Each test case contains a string in a line, which represents the equation Little Rabbit writes down. The length of the string is at most 15. The input is terminated by the end-of-file.

The equation's format: number, operator, number, =, number. There's no whitespace in the string.

Each number has at least 1 digit, which may contain digital numbers 0 to 9 or uppercase letters A to F (which represent decimal 10 to 15). The number is guaranteed to be a non-negative integer, which means it doesn't contain the radix point or negative sign. But the number may contain leading zeros.

The operator refers to one of $+$, $-$, $*$, or $/$. It is guaranteed that the number after / will not be equal to 0. Please note that the division here is not integer division, so $7/2 = 3$ is not correct.

Output

For each test case, output an integer r ($2 \le r \le 16$) in a line, which means the equation is correct in the system with radix r. If there are multiple answers, output the minimum one. If there is no answer between 2 and 16, output -1.

Example

standard input	standard output
1+1=10 18-9=9 AA*AA=70E4 7/2=3	2 10 16 -1

Problem C. Borrow

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Alice, Bob and Cindy are good friends. They go shopping together and buy the same. However, they don't bring the same units money with themselves so one of them suggests that the one with the most money should borrow 1 unit money to someone else with equal probability. That is to say, if they have $x, y, z (x \geq y \geq z)$ units money separately, the one with x units money (if multiple people have the most then they decide one should borrow with equal probability) will give 1 unit to one of his/her friends with equal probability. After that, they have $x-1, y+1, z$ or $x-1, y, z+1$ units money.

This act will last until everyone has the same units money. Three smart guys want to know the expected times of this act or if this situation will never come.

Input

The input contains several test cases. The first line contains a single integer T, indicating the number of test cases. Following T lines, each line contains three integer x, y, z indicating the money of three guys.

$x + y + z \leq 10^6, \sum x + y + z \leq 3 \times 10^6$

Output

For each test case, if the situation that everyone has the same units money will never come then print -1, else print the expected times in a line. If the expected times is $\frac{P}{Q}$, you should output $P \cdot Q^{-1}$ mod 998244353, where Q^{-1} denotes the multiplicative inverse of Q modulo 998244353.

Example

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

Problem D. Asteroid in Love

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	256 megabytes

During the summer vacation, the geoscience community launched a constellation observation activity.

On a clear night, Mira and Ao set up their telescopes. Through the telescopes, they observed n stars. These n stars could be regarded as points on a two-dimensional plane, with coordinates (x_i, y_i).

It was boring to observe the stars alone, so they classified these stars into three categories according to their spectrum: R-type stars, G-type stars, and B-type stars.

Now, Mira wants to form a constellation named after Ao, for Ao to make up for the regret that there is no star named after Ao. This constellation should be small and beautiful. She wants the number of stars to be the least in this constellation. Besides, she wants the constellation contains all types of stars. It is easy to know that this constellation has only three stars, and the types of these three stars are R type, G type, and B type.

She also wants the area of the convex polygon enclosed by the stars of this constellation is the largest, that is, the area of the triangle formed by these three stars is the largest. If the triangle is trivial (that is, the three points that make up the triangle are on the same straight line), the area of the triangle is considered to be 0.

Please tell Mira the largest area of Constellation Ao.

Input

The first line contains an integer T, indicating the number of testcase.

For each testcase, the first line contains a positive integer n, indicating the number of stars observed.

From line 2 to line $n + 1$, each line contains three integers x, y, c. Line i describes the information of the stars $i - 1$, where x, y are the horizontal and vertical coordinates of the star's position, that is, the coordinates of the star are (x, y); c is for the description of stellar types, 0 indicates that the stars are B-type stars, 1 indicates R-type stars, and 2 indicates G-type stars.

$T \leq 10, 3 \leq n \leq 3 \times 10^3, |x|, |y| \leq 10^9, 0 \leq c \leq 2$

It is guaranteed that there exists a Constellation Ao, and any two stars will not be in the same position.

Output

For each testcase, output one real number per line indicates the maximum area. The answer should be rounded to one decimal place.

Example

standard input	standard output
2 8 3 1 0 -5 3 0 -1 1 1 -1 -1 0 -2 1 0 2 -4 0 1 1 0 7 7 2 17 -5 1 0 -4 1 0 -3 1 0 -2 1 0 -1 1 0 0 1 0 1 1 0 2 1 0 3 1 0 4 1 0 5 1 0 -2 3 1 -4 2 1 7 5 1 9 1 2 7 3 2 -1 3 2	29.0 28.0

Problem E. Fragrant numbers

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	64 megabytes

Many people love numbers, and some have a penchant for specific numbers. Nowadays in popular culture, 1145141919 is a very fragrant number, and many people want to represent all other numbers with this number.

Let S be an infinite string of "1145141919"infinitely stitched together as "1145141919114514191911451419 19...".

Take a prefix T of S , you can insert '(' , ')' , '+' or '$*$' to T to form a new string T', and then let the value of T' be $val(T')$ according to ordinary rules. (You can insert any number of operators, even 0. But need to ensure that the inserted operators form legitimate operations)

Now for a number N, please calculate the minimum length of T that can make $val(T') = N$. For example, when $N = 520$, the minimum length of 6 (pick the first 6 characters 114514 and insert operators to make $T' = 1 + 1 + 4 + 514$, then we have $val(T') = 520$)

If no such T exists, output -1.

Input

There are multiple test cases.

The first line with a number t indicates the number of test cases.

For each test case, one integer N per line indicates an inquiry.

$1 \leq t \leq 30$

$1 \leq N \leq 5000$

Output

Output t lines.

One integer per line indicates the corresponding answer.

Example

standard input	standard output
3 520 1 2	6 1 2

Problem F. A Very Easy Graph Problem

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2.5 seconds
Memory limit:	64 megabytes

An undirected connected graph has n nodes and m edges, The i-th edge's length is 2^i. Each node i has a value a_i, which is either 0 or 1. You need to calculate:

$$\sum_{i=1}^{n}\sum_{j=1}^{n} d(i,j) \times [a_i = 1 \wedge a_j = 0]$$

$d(i,j)$ indicates the shortest distance between i and j. [ ] is the Iverson bracket. $\wedge$ indicates `AND`.

Because the answer may be too large, please output the answer modulo $10^9 + 7$.

Input

The first line contains one ingeter T.

The second line contains two ingeters $n, m (1 \le n \le 10^5, 1 \le m \le 2 \times 10^5)$.

The third line contains n positive integers $a_1, a_2, ..., a_n (a_i = 0 \text{ or } 1)$ —— the value of the nodes.

The following m lines contain two ingeters $u, v (1 \le u, v \le n)$, and the i-th line represents the i-th undirected edge's length is 2^i, between node u and v.

The sum of n, m is no more than 2×10^5.

Output

Print a single integer—— the value of the answer modulo $10^9 + 7$.

Example

standard input	standard output
1 3 2 0 1 0 3 1 3 2	10

Problem G. A Very Easy Math Problem

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	64 megabytes

Given you n, x, k , find the value of the following formula:

$$\sum_{a_1=1}^{n}\sum_{a_2=1}^{n}\cdots\sum_{a_x=1}^{n}\left(\prod_{j=1}^{x}a_j^k\right)f(\gcd(a_1,a_2,\ldots,a_x))\cdot\gcd(a_1,a_2,\ldots,a_x)$$

$\gcd(a_1, a_2, \ldots, a_n)$ is the greatest common divisor of $a_1, a_2, ..., a_n$.

The function $f(x)$ is defined as follows:

If there exists an integer $y > 1$ and $y^2|x$, $f(x) = 0$. Else, $f(x) = 1$.

Input

The first line contains three integers t, k, x $(1 \le t \le 10^4, 1 \le k \le 10^9, 1 \le x \le 10^9)$

Then t test cases follow. Each test case contains an integer n $(1 \le n \le 2 \times 10^5)$

Output

For each test case, print one integer — the value of the formula.

Because the answer may be very large, please output the answer modulo $10^9 + 7$.

Example

standard input	standard output
3 1 3 56 5 20	139615686 4017 11554723

Problem H. Yukikaze and Smooth numbers

Input file:	standard input
Output file:	standard output
Time limit:	10 seconds
Memory limit:	512 megabytes

Yukikaze is learning number theory. In number theory, a k-smooth number is an integer whose prime factors are all less or equal to k . Given n and k, she wants to know how many k-smooth numbers are less or equal to n.

Input

The input contains several test cases, and the first line contains a single integer $T(1 \leq T \leq 50)$, the number of test cases. Each of the next T lines contains two integers $n(1 \leq n \leq 10^9), k(1 \leq k \leq 10^9)$, denoting the question described above.

Output

For each test case, output the answer in a single line.

Example

standard input	standard output
5 13 2 75 18 38 8 24 7 62 9	4 54 25 18 34

Problem I. Divisibility

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	64 megabytes

You are given two 10-based integers b and x, and you are required to determine the following proposition is true or false:

For arbitrary b-based positive integer $y = \overline{c_1 c_2 \cdots c_n}$ (c_i is the i-th dight from left of y), define $f(y) = \sum_{i=1}^{n} c_i$, if $\underbrace{f(f(\cdots f(y)\cdots))}_{\infty}$ can be divided by x, then y can be divided by x, otherwise y can't be divided by x.

Input

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

For each test case, there is a single line containing two 10-based integers b and x ($2 \le b, x \le 10^{18}$).

Output

For each test case, if the proposition is true, print "T otherwise print "F"(without quotes).

Example

standard input	standard output
1 10 3	T

Problem J. Expectation

Input file:	`standard input`
Output file:	`standard output`
Time limit:	5 seconds
Memory limit:	512 megabytes

You are given an undirected graph consisting of n vertices with m weighted edges. We define the weight of a spanning tree as the bitwise AND of all edges' weight in spanning tree.

Now select a spanning tree randomly, you should calculate the expected value of the weight of this spanning tree. You are required to print the result mod 998244353. *i.e.*, print $x \times y^{-1}$ mod 998244353 where $x \times y^{-1}$ is the irreducible fraction representation of the result, where y^{-1} denotes the multiplicative inverse of y modulo 998244353.

Input

The first line is an integer $t(1 \leq t \leq 10)$, the number of test cases.

For each test case, there are two space-separated integers $n(2 \leq n \leq 100)$ and $m(1 \leq m \leq 10^4)$ in the first line, the number of nodes and the number of edges.

Then follows m lines, each contains three integers $u, v, w(1 \leq u, v, \leq n, 1 \leq w \leq 10^9, u \neq v)$, space separated, denoting an weight edge between u and v has weight w.

Output

For each test case, output a single line with a single integer, denoting the answer.

Example

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

Problem K. Kirakira

Input file:	`standard input`
Output file:	`standard output`
Time limit:	5 seconds
Memory limit:	256 megabytes

There are n stars in the sky. At every moment, the i-th of them has a probability of $u_i/v_i (1 \le u_i < v_i < P = 31607)$ to become visible. All stars are independent of each other. The position of a star can be described as a coordinate on a 2D plane. No two stars share the same coordinate. Your task is to compute the expectation value of the area of the convex hull formed by the visible stars. Formally, let $P = 31607$. It can be shown that the answer can be expressed as an irreducible fraction p/q, where p and q are integers and $q \not\equiv 0 \pmod{P}$. Output the integer equal to $p \cdot q^{-1} \bmod P$. In other words, output such an integer x that $0 \le x < P$ and $x \cdot q \equiv p \pmod{P}$.

Input

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

For each test case, the first line contains a single integer $n (1 \le n \le 1000)$, denoting the number of stars.

Each of the following n lines describes a stars. The i-th line of them contains 4 integers $x_i, y_i, u_i, v_i (-1000 \le x_i, y_i \le 1000, 1 \le u_i < v_i < P = 31607)$ indicating the coordinate of the i-th star and the probability of the i-th star to become visible. It is guaranteed that no two stars share the same coordinate.

There are at most 3 test cases satisfying $n > 20$.

Output

Output the integer equal to $p \cdot q^{-1} \bmod P$ denoting the answer.

Example

standard input	standard output
2 4 0 0 1 2 1 0 1 2 0 1 1 2 1 1 1 2 4 0 0 1 2 1 0 1 2 -1 0 1 2 0 1 1 2	21730 21730