BRACU Traction Inter University Individual Programming Contest

https://toph.co/c/bracu-traction-inter-university

Toph

Schedule

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

The standings will be frozen for the last **1h0m0s** of the contest.

Authors

The authors of this contest are Chronos, flash_7, fsshakkhor, imAnik, masrur, user.424868, and Zeronfinity.

Rules

This contest is formatted as per the official rules of ICPC Regional Programming Contests.

You can use Bash 5.0, Brainf*ck, C# Mono 6.0, C++11 GCC 7.4, C++14 GCC 8.3, C++17 GCC 9.2, C11 GCC 9.2, Common Lisp SBCL 2.0, Erlang 22.3, Free Pascal 3.0, Go 1.13, Haskell 8.6, Java 1.8, Kotlin 1.1, Node.js 10.16, Perl 5.30, PHP 7.2, PyPy 7.1 (2.7), PyPy 7.1 (3.6), Python 2.7, Python 3.7, Ruby 2.6, and Whitespace in this contest.

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

Notes

There are 6 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. Fivefold Removals

Limits 1s, 1.0 GB

Alice and Bob are playing a simple game on marbles.
They have a bucket containing **N** marbles, and the rules of the game are as follows:

1. Alice and Bob alter their turns, while Alice makes the first move.
2. Each move consists of removing one or more marbles from the bucket.
3. In the first move, Alice can remove any number of marbles, but not all the marbles in the bucket.
4. In subsequent moves, the current player can remove at most **five** times the number of marbles removed by the other player in the last move.
5. The player who cannot make a move loses. The other player is considered the winner.
6. Both player plays optimally.

Input

First line of the input contains a single integer **t** ($1 \leq \mathbf{t} \leq 10^5$) - denoting the number of test cases.

Next **t** lines each contains a single integer **N** ($1 \leq \mathbf{N} \leq 10^{18}$) - denoting the number of marbles in the bucket.

Output

For each test case, output the winner of the game (**Alice** or **Bob**) in a single line.

Samples

Input	Output
8 2 4 6 7 8 10 12 14	Bob Bob Bob Alice Bob Bob Bob Alice

Input	Output
For N=4, Alice can remove 1 or 2 or 3 marbles in his first move. Bob removes the remaining marbles in the next move. Alice cannot make any move and Bob wins. For N=7, Alice will remove only 1 marble in his first move. Then Bob can remove maximum 1 × 5 = 5 marbles in his move, but not all the remaining 6. Alice will remove the remaining marbles in his next move and win.	

B. Who Gets the Money!?

Limits 1s, 512 MB

Who doesn't get happy after getting money in the pockets of clothes before washing them? During this pandemic, Jenia washes clothes at home as they don't keep a maid as outsiders are not allowed at home to avoid risk. Even though Jenia gets the money while washing, but she and her siblings end up in a fight while claiming the money. Jenia has twin siblings, Umair and Zuaina. Since school is closed so her siblings don't study at all. Thus Jenia thought of a game to avoid the chaos for money as well as make her siblings practice mathematics. It's a game where the twin will compete jenia as a team. So she gave the twins N pieces of paper and asked them to write positive odd numbers sequentially but following a rule. The rule is :

- They will write one positive odd number in the first paper which is 1.
- In the second paper, they will write the next two positive odd numbers which are 3 ,5.
- In the third paper, they will write the next three positive odd numbers which are 7, 9, 11.
- In the fourth paper, they will write 13, 15, 17, 19. They must continue writing these papers until the Nth piece of paper following this rule.

Zuaina will keep the papers where the total number of numbers written on a paper is even. Umair will keep the rest. Both of them will separately find the sum of all the numbers in all the papers they currently have. Let Zuaina's sum is S_1 and Umair's sum is S_2.

The next task of the twins is to find the total sum S where $S = S_1 + S_2$. The prize money of this game is, $R_{actual} = S\%P$ where P is the money that was found in the pockets. It is always guaranteed that P is a prime number. The twins will try to find the correct value of prize money, but they might make mistakes in the calculation as they are still learning about modulo operation. Let's say the prize money that twins calculated is .

If =R_{actual} then the twins gets the prize money and Jenia will get to keep the rest of the money. If $\neq R_{actual}$ then Jenia will keep the prize money and the twins will keep the rest of the money. It doesn't matter if the prize money, R_{actual}, is greater or less than the rest of the money, $P - R_{actual}$. That's the fun part of this game.

Jenia is busy with her online classes and is unable to check the result. Given N, P and , can you be the judge and let them know how much Jenia and the team of twins will get.

Input

The input contains a single line with three integers N, P, where $1 \leq N \leq 10^{12}$,P is a prime in the range $(1, 5000)$ and .

Output

Print two integers that indicate the amount Jenia and the team of twins will get sequentially separated by a space between them.

Samples

Input	Output
4 53 47	6 47

Input	Output
4 53 23	47 6

Here, N = 4 so there will be 4 papers.
Zuaina will have 3, 5, 13, 15, 17,19 and Umair will have 1, 7, 9, 5
S_1 = 72, S_2 =28, S=100, R_{actual} = 100%53 = 47
So in the first sample input =R_{actual}, Jenia will get 6 and the twins will get 47.
In the second sample input $\neq R_{actual}$, Jenia will get 47 and the twins will get 6.

C. Poga and Circles

Limits 3s, 1.0 GB · Custom Checker

Are you tired of big complicated problem statements? Well, you are in luck, here's a simple one just for you!

Poga has N circles.

Tama likes to bother Poga by giving her Q vertical straight lines. For each line, Poga needs to tell the highest point of the line where that line intersects any circle from the N circles Poga has.

Can you help her find that?

Input

Input starts with two space-separated integers N and Q in a single line.

In the following N lines, the i-th line contains three space-separated integers H_i, K_i and R_i such that the center of Poga's i-th circle is (H_i, K_i) and its radius is R_i.

Then Q lines follow, i-th one representing the i-th vertical line. In each of these lines, a single integer X_i is given, representing $X = X_i$ vertical line.

Constraints

$1 \leq N, Q \leq 10^5$
$-10^9 \leq H_i, K_i, X_i \leq 10^9$
$1 \leq R_i \leq 10^9$

Output

For each vertical line, find the Y value such that (X, Y) is the intersecting point between the line and any of the N circles, and Y is maximum.

Your answer will be accepted if its relative or absolute error does not exceed 10^{-6}.

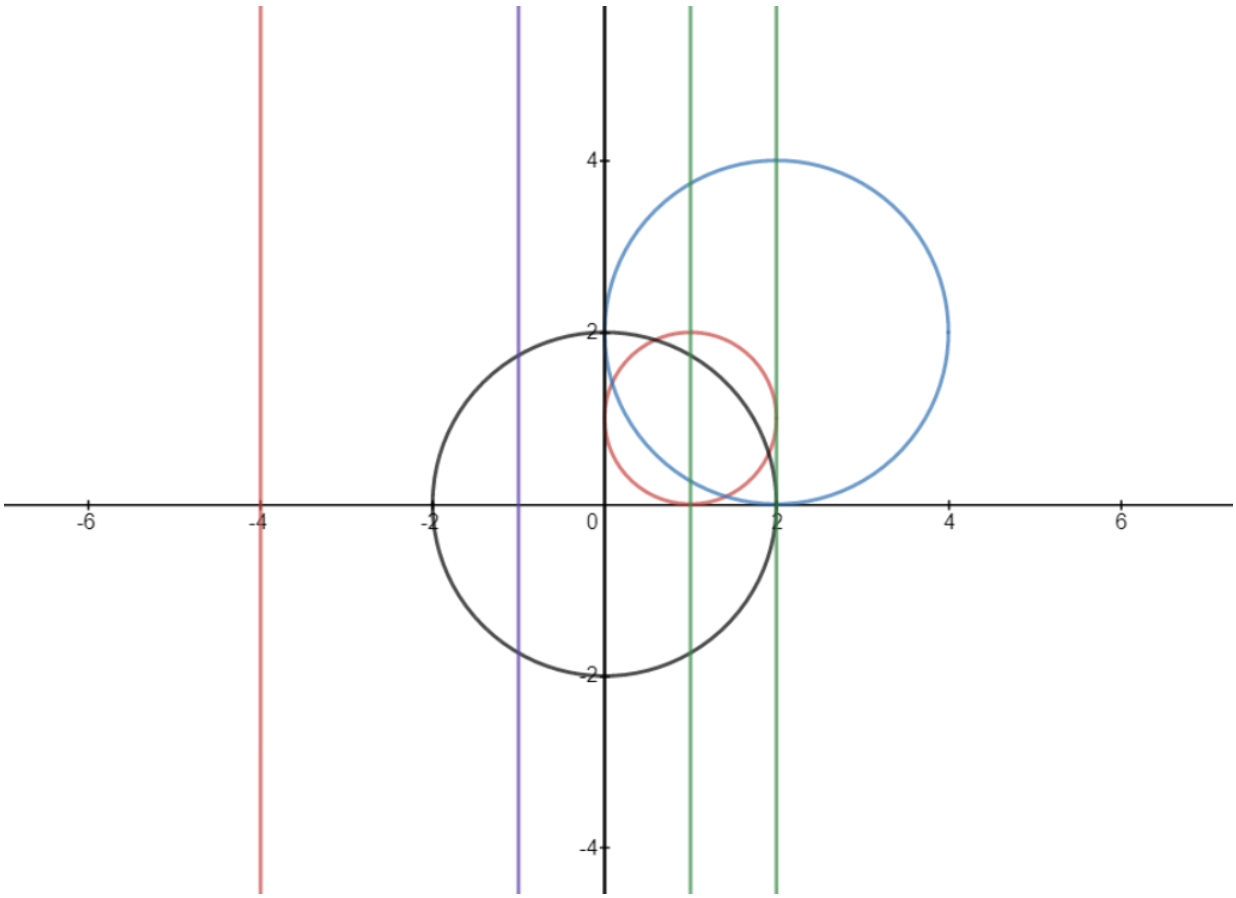
Formally, if your answer is Y and the judge's answer is Z, your answer is accepted if and only if $\frac{|Y - Z|}{max(1, |Z|)} \leq 10^{-6}$.

If no answer exists for a line, print “None” instead of the Y value.

Samples

Input	Output
3 5 1 1 1 2 2 2 0 0 2 1 2 -1 0 -4	3.732050808 4.000000000 1.732050808 2.000000000 None

The following picture represents the sample input.



D. Game Show

Limits 1s, 1.0 GB

Alex is participating in a game show. Mr. Phil is the host of the game. Alex is provided with an array containing **N** distinct integers from **1** to **N**. Mr. Phil has the same copy of the array. There are two phases of the game.

Phase 1: A wheel is rolled. The wheel will show a random integer in between **0** and **N**. Let the number be **X**. Then **X** integers will be randomly selected from Alex's array and removed. Now Mr. Phil's array contains **N** integers, but Alex's array contains **N - X** integers.

Phase 2: Again the wheel is rolled. This time the wheel will show a random integer between **0** and **N - X**. Let the number be **K**. Mr. Phil will randomly pick **K** integers from his array. If Alex's array contains all these **K** integers that were selected by Mr. Phil, then Alex wins.

Here is a simulation of the game.

Suppose **N = 3**. Initially Alex's array is **[1 2 3]** and Mr. Phil's array is **[1 2 3]**

In phase 1, the wheel shows **X = 1**. So **1** integer will be removed from Alex's array. Let it be number **2**. So currently Alex's array is **[1 3]** and Mr. Phil's array is **[1 2 3]**.

In phase 2, the wheel shows **K = 2**. So Mr. Phil will randomly pick **2** integers from his array.

If he picks **[1 3]**, Alex wins.
If he picks **[1 2]** or **[2 3]**, Alex loses.

You have to find the probability of Alex winning the game. The probability can be written in form $\frac{P}{Q}$, where P and Q are relatively prime integers and $Q \neq 0 \mod 998244353$. You have to print the value of $(PQ^{-1}) \mod 998244353$.

Input

First line contains an integer **T (1 ≤ T ≤ 5000)** denoting the number of test cases.

Each of the next **T** lines contain an integer **N (1 ≤ N ≤ 30000000)**.

Output

For each test case, output the value of (PQ^{-1}) mod 998244353.

Samples

Input	Output
3 1 2 4	1 415935148 393751940

For **N = 2**, the probability of alex winning the game is $\frac{11}{12}$.

E. Chance of Passing the Quiz

Limits 1s, 512 MB

Rocky is starting his online quizzes and he has been provided with some passing criteria. The rule of passing the online quiz is to obtain at least a certain mark. Rocky's friend Gillan is good at computing and Rocky always takes his help in need. Rocky asks gillian about this passing criteria and asks Gillian to help find out his probability of passing the quiz if he guesses the answer of each question randomly from the available options without any thinking. Gillian thought sometime and told Rocky he will provide Rocky a program so that Rocky can estimate in advance his probability of passing the quiz if the number of quiz questions are known early.

A quiz consists of N MCQ questions. Each question has two options: $True$ and $False$. Each question is assigned 1 mark, so Rocky's total marks will increase by 1 for correctly answering each question . Rocky needs to have a score of at least $X\%$ in order to pass the quiz. What is the probability that Rocky will pass the quiz if he guesses the answer for each question randomly from the available options?

Input

There will be tests and then there will be T lines each will have Integer and Integer as input

Output

For each test case, output a single floating point number denoting Rocky's probability of passing the quiz. Your output should be rounded to exactly 2 digits after the decimal point.

Samples

Input	Output
5 20 65 20 55 30 45 25 65 30 35	0.13 0.41 0.71 0.05 0.95

F. LCM Divisible Subsequence

Limits 5s, 512 MB

You'll be given an array of N integers and two more integers K and M. You have to find the number of ***lcm divisible subsequence*** of length M in that array.

A subsequence of length M is called ***lcm divisible subsequence*** if the LCM (Lowest Common Multiple) of all the numbers in that subsequence is divisible by K. For example, if $A = [2, 2, 3, 4, 7, 6]$, $M = 3$ and $K = 6$, then $(2, 2, 6)$ is a valid ***lcm divisible subsequence***. Because the length of this subsequence is $M = 3$ and the LCM is 6, which is divisible by $K = 6$.

Note: A subsequence in the array A is a sequence that can be derived by deleting some or no elements without changing the order of the remaining elements in the array A. Two subsequences are considered different if the chosen indices are different.

Constraints

$1 \leq T \leq 5$
$1 \leq N \leq 100000$
$1 \leq M \leq 1000$
$1 \leq K, A_i \leq 50000$

Input

The first line of the input contains a single integer T denoting the number of test cases, then T test cases follow. The first line of a test case contains three integers N, M and K. The following line of the test case contains N space separated integers of the array A.

Output

For each test case print a single integer, the number of ***lcm divisible subsequence*** in the given array. Since the answer can be quite large, you have to compute it modulo 998244353.

Samples

Input	Output
5 3 2 2 2 3 4 4 3 9 2 4 5 6 5 3 6 2 8 12 5 6 6 3 6 2 2 3 4 7 6 10 3 6 2 3 6 12 16 18 20 25 9 24	3 0 9 16 115

In the first test case, the list of valid *lcm divisible subsequence* is given below:

1. 2, 4 (LCM = 4, which is divisible by 2)
2. 2, 3 (LCM = 6, which is divisible by 2)
3. 3, 4 (LCM = 12, which is divisible by 2)

In the second test case, there's no valid *lcm divisible subsequence*.

In the third test case, some valid *lcm divisible subsequences* are given below:

1. 2, 8, 12 (LCM = 24, which is divisible by 6)
2. 2, 12, 6 (LCM = 12, which is divisible by 6)
3. 8, 12, 6 (LCM = 24, which is divisible by 6)

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