PROGRAMMING CONTEST PROBLEM SET

This problem set contains 10 problems (A-J)

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Hosted by
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A. Find the Pair!

Time Limit: 1 seconds

Baim has a little sister named Julia. One day, his parents ask him to check Julia's mathematics homework. His little sister just learns subtraction in kindergarten. However, Baim is too lazy to help his little sister. To help Baim, you need to write a program that reads an array of positive numbers, T and a number n – difference of the pair. Then, the program will find the pair in the array and print the result if such a pair is found or not found in the array.

Input

First line should contain an array of T **(**$2 \leq T \leq 10$**)** numbers with each number separated with a space.
Second line should contain a number n representing the difference of a pair of numbers.

Output

If pairs are found, the output will be "Pair Found: (A_1 , B_1), (A_2 , B_2)… (A_n , B_n)", where $A_i <= A_{i+1}$. If no pair are found, print "No Pair Found".

Sample Input	**Sample Output**
5 10 15 23 5	Pair Found: (5, 10), (10, 15)
1 2 3 6 7	No Pair Found

B. What's the Reading ?

Time Limit:3 seconds

Ahmad is working for a company called BigOilCorp. BigOilCorp installed a sensor in one of their pipeline to measure the flow rate of gas. Unfortunately, the sensor is a bit faulty and sends the reading at random times. You are given a list of readings of the sensor and a list of query. The sensor reading each consist of a time and the flow rate. Each query is a time at which you have to give the last reading at that time, the time of the reading, and the time of next reading.

Input

The first line contains two integer $n,\ q\ \ (1 \le n,\ q \le 100000)$ which is the number of readings and the number of query.

The next n lines consist of two integer t and $x\ \ (0 \le t,\ x \le 100000)$ which is the timestamp and the sensor reading.

The next q lines consist of an integer $a\ \ (0 \le a \le 100000)$ which is the time at which you have to give the result.

Output

For each query, you have to give three integer, $r,\ f,\ t$ which is the last reading, the time of the last reading, the time of the next reading.

If there is no next reading, output `-1` for the time of the next reading.
If there are no reading yet, output `-1` for the last reading and the time.

Sample Input	**Sample Output**
5 6 1 4 6 10 8 0 9 9999 60 2 6 7 8 45 80 0	10 6 8 10 6 8 0 8 9 9999 9 60 2 60 -1 -1 -1 1

Sample Description

In sample 1, there are 5 readings.

Time: 1, Reading: 4,
Time: 6, Reading: 10,
Time: 8, Reading: 0,
Time: 2, Reading: 9999,
Time: 60, Reading: 60.

There are 5 query,

At time 6, the last reading is at time 6 which is 10 and the next time is 8.
At time 7, the last reading is at time 6 which is 10 and the next time is 8.
At time 8, the last reading is at time 8 which is 0 and the next time is 9.
At time 45, the last reading is at time 9 which is 9999 and the next time is 60.
At time 80, the last reading is at time 60 which is 2 and there is no next reading so the next time is given -1.
At time 0, there are no reading yet, so the reading is -1 and the time is -1. The next time is 1.

C. Count

Time Limit: 1 second

Ariff Yasri likes to think. Well, he thinks too much most of the time. He had one problem that he has been thinking for two days now.

He is thinking, how many ways he can make N digit numbers that are formed by ones and zeros, with a catch…. zeros cannot be next to each other.

Can you help Ariff to count of different numbers can he make by using above rules?

Input

The first line contains $T\ (1 \le T \le 100),$ the number of test case(s).
The following T lines contain N ($1 <= N <= 1000$), where N is a positive integer.

Output

Number of ways he can make N digit numbers that are formed by ones and zeros, where zeros cannot be next to each other.

Sample Input	**Sample Output**
3 1 2 3	2 3 5

Sample Description

Explanation for above sample data:

N = 1: 0, 1 (count=2)
N = 2: 11, 10, 01 (count=3)
N = 3: 101, 010, 111, 110, 011 (count=5)

D. Smart Garbage Disposal System

Time Limit: *1 second*

A smart city is a designation given to a city that incorporates information and communication technologies (ICT) to enhance the quality and performance of urban services such as energy, transportation, and utilities in order to reduce resource consumption, wastage and overall costs. The objective of a smart city is to make the city more liveable. There are many components covered in smart city development and one of it is smart waste management.

As a developer for the Smart Garbage Disposal System (SGDS), you required to build a program to compute the minimum number of bags needed to dispose a household garbage as one of the objectives of a smart city is to manage resources efficiently.

For each of n days, a_i (number of units of garbage) are produced on the i^{th} day. Each unit of garbage must be disposed during the day it was produced or on the next da*y*. The garbage will be put in a bag before the bag dropped into the garbage container. Each bag can hold up to g unit of garbage and drop multiple garbage bag into the container in a single day are allowed. You must make sure that no garbage should be left after n^{th} day**.**

Input

The first line of the input contains two integers n and b **(** $1 \le n \le 2 \cdot 10^5,\ 1 \le b \le 10^9$ **)** – the number of days and garbage bag capacity. The second line contains n number of integers g_i ($0 \le g_i \le 10^9$) – the number of unit of garbage produced for i^{th} day.

Output

A single integer which is the minimum number of bags needs to dispose all of the garbage.

Sample Input	Sample Output
3 2 3 2 1	3
4 4 2 8 4 1	4

E. Give me Path

Time Limit: 1 second

Ariff just joined UITM Shah Alam. As a new student, it is challenging for Ariff to get around the campus due to UITM's maze-like routes. Thus he has taken hold of the university map from the information center. Since Ariff is a lazy boy, he wants to find the shortest path with the least effort to reach his class, C, from his dormitory, D. He wants to avoid the long stairs, S, scattered around the campus as much as possible as it takes five times more efforts than a normal path, _. He also cannot go through other building blocks, #, as he does not have the necessary access. Can you help Ariff find his way?

Things to be noted:
There is only one starting point (the dormitory), D, and goal (the class), C
Exactly one shortest path from the dormitory to the class

Input

The first line contains 2 space-separated integers, N and M ($1 <= N, M <= 100$), respectively, denoting the maze matrix size.
The N subsequent lines each contain a string of length M describing a row of the maze matrix.

Output

The path is taken, with least effort, to reach the class from the dormitory. The path movement should be described as ***Upward (*** U ***), Downward (*** D ***), Right (*** R ***)*** and ***Left (*** L ***)***.

Sample Input	**Sample Output**
6 4 D__# ##_# ___# _#S# _#_C ___#	RRDDDDR

Sample Description

Explanation for above sample data:

Ariff moves two steps to the right, then he moved three steps down. He observed that he can either use stairway (5 steps) or not using stairway (6 steps). He chose to use stairway as it proved that it is much shorter. He then finished by moving one step to the right.

F. Calculator

Time Limit: 1 second

Remember your first programming assignment? Where your lecturer asked you to implement your own calculator? :) Well, to bring back that nostalgic feeling, you need to implement your own simple calculator, right now. :D

Input

The first line contains $T\ (1 \le T \le 100)$, the number of test case(s).

The following T lines contains $A,\ O,\ B,$ where A & B $(0 \le A,\ B \le 10,000)$ are first float number and second float number respectively, and O is a character representing the operator. O will consist one of the following operators: $+,\ -,\ *,\ /$, which these represent addition, subtraction, multiplication, and division respectively.

Output

Do the calculation based on operation O and print its calculated value. The number must be formatted into two decimal places. If the operation is impossible to be done, then print "NaN".

Sample Input	**Sample Output**
2 1.00 + 1.00 3.00 / 1.00	2.00

G. Narrow It Down!

Time Limit: 1 second

Write a program that reads an array of positive numbers and prints the difference between successive pairs and repeat the process using previous output until 1 number is left.

Input

First line should contain an array of $T\ (2 \le T \le 10)$ numbers with each number separated with a space.

Output

Output the numbers until **one (1)** number is left.

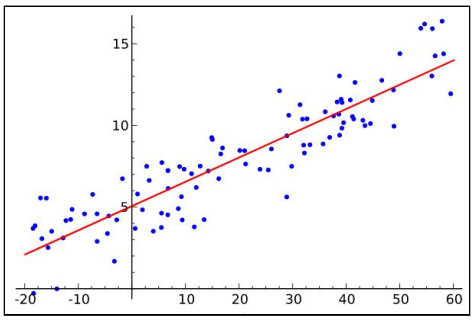
Sample Input	**Sample Output**
10 33 65 204 9 21	23 32 139 195 12 9 107 56 183 98 51 127 47 76 29

H. Linear Regression

Time Limit: 1 second

Linear regression is a commonly used predictive analysis method in Statistics. It is an approach to modeling the relationship between a dependent variable and a given set of independent variables.

It is defined mathematically as $y = \alpha + \beta x$, which describes a line with slope β and y-intercept α. The goal of linear regression is to find estimated values α and β, which would provide the "best" fit for the data. Best fit here refers to a line that minimizes the errors. Errors mean the differences between ***predicted*** y value and ***actually*** y value.



Red-line which "fits" through blue dotted points

The simplest form of linear regression is called *simple linear regression*. It is a statistical method that allows us to summarize and study relationships between two continuous (quantitative) variables. One variable denoted x is regarded as a *data* variable and other one denoted y is regarded as a *result* variable.

There exists a formula to calculate values slope β and y-intercept α in the case of simple linear regression, where it is defined as:

$$\hat{\alpha} = \bar{y} - \hat{\beta}\,\bar{x},$$
$$\hat{\beta} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

Bar (eq; $\bar{x}$) on top of variable means average of all values

Given a set of x and y values, calculate both slope β and y-intercept α values using above formula. By having these two values, then predict y value with new x data based on the equation $y = \alpha + \beta x$.

Input

The first line contains $N\ (1 \le N \le 100),$ the number of dataset row.
The following *N* lines contain two floats x, y (-100 <= x,y <= 100), where x is a data value, and y is a result value.

Next line contains $X (1 \leq X \leq 10),$ the number of new x values to be predicted. The following X lines contain a float x_{new} , where x_{new} $(-100 \leq x_{new} \leq 100).$

Output

Print value of β and α with a space as their delimiter, together with a newline. Both β and α must be printed with four decimal places.

Predict x_{new} using $y = \alpha + \beta x$ and print the y value together with a new line. Y must be printed with four decimal places.

Sample Input	**Sample Output**
5 2.00 4.00 3.00 5.00 5.00 7.00 7.00 10.00 9.00 15.00 2 1.00 12.00	1.5183 0.3049 1.8232 18.5244

I. Prime Test

Time Limit: 1s

Given an integer number, find out whether it's a prime number.

Input

The first line contains $T\ (1 \le T \le 50)$, the number of test case(s). The subsequence T lines contain an integer $N\ (2 \le N \le 10,000).$

Output

For each test cases, find out whether N is prime, if yes, then print out '*Prime*', otherwise, print the smallest prime factor of N.

Sample Input	**Sample Output**
4 5 13 14 25	Prime Prime 2 5

J. Ahmad's Tree

Time Limit:3 seconds

Ahmad owns a forest filled with the magical trees. All Ahmad trees are planted in a single straight line. Lets number these tree from 1 to n. These trees are magical as they grew as soon as they receive rain. The amount that the tree grow depends on how hard it rains. Because Ahmad's forest is so big, when it rain, only part of the forest receive the rain, hence only some segment of trees grew. When the height of the tree grew above k meter, Ahmad will cut the top k meter and sells it until its height is less than k meter. Because these tree are so magical, they need great care. Every night, Ahmad must cover the trees with several Magic Tent. These tent are magical because they can extend in the horizontal direction infinitely. Unfortunately, a magic tree of a certain height must use a tent of exactly the same height. Meaning several consecutive tree of the same height can share a tent. Obviously, magical tent are expensive. So everyday, Ahmad needs to know how many tent he need in order to cover up his forest. Given a description on the segment of forest that grew on several days, determine how many tent is needed to cover all trees on each day.

Note that originally all tree has a height of 0 and unlike in Malaysia, it only rains once every day. Ahmad will always cut the top k meter of the tree that reached that height.

Input

The first line contains three integer $n,\ k,\ d$ ($1 \le n, k, d \le 100000$) which is the length of the forest, k which is the height at which Ahmad will cut the tree and d which is the number of days.

The next d lines each contains tree integer a, b and h ($1 \le a \le b \le 100000,\ 1 \le h \le 100000$) where a and b denote the segment that grew on that day is the tree from a to b and h is how much it grow.

Output

For each day, in its own line, output the number of magic tent required for the day.

Sample Input	**Sample Output**
4 8 4 1 4 5 1 1 7 2 4 4 3 4 1	1 2 2 3
4 8 4 1 1 8 2 2 8 3 3 8 4 4 8	1 1 1 1

Sample Description

In sample 1, the tree high at the end of each day will be like this:

Day 1: 5 5 5 5 (only 1 tent required)
Day 2: 4 5 5 5 (The first tree add by 7 become 12, then the top 8 is cut away leaving 4. 2 tents is required)
Day 3: 4 1 1 1 (2 tents are required)
Day 4: 4 1 2 2 (3 tents are required)

In sample 2, the tree high in the end of each day will be like this:

Day 1: 0 0 0 0 (1 tent is required)
Day 2: 0 0 0 0 (1 tent is required)
Day 3: 0 0 0 0 (1 tent is required)
Day 4: 0 0 0 0 (1 tent is required)