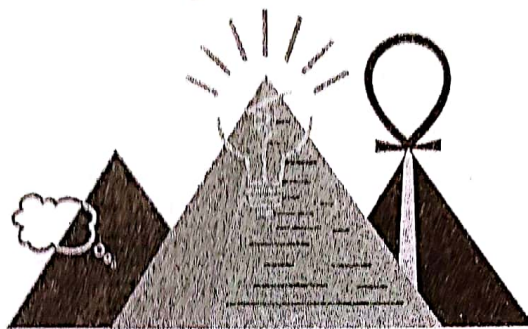International Collegiate Programming Contest
The 2022 ECPC Contest
AAST, Egypt
August 2022

The International Collegiate Programming Contest
Sponsored by ICPC Foundation

EGYPTIAN COLLEGIATE
PROGRAMMING CONTEST

The 2022 ECPC Contest

18-08

(Contest Problems)

AAST, Egypt
August 2022

Problem A. A Story

Input file:	story.in
Output file:	standard output
Balloon Color:	Orange

Once upon a time in a world that looks like ours a story of a person who looks like many of us is about to begin and it unravels like a jigsaw puzzle. Make sure to open your eyes and focus, as things can look like a duplicated version of another person's story but soon you will know that it is exceptionally different than any other story you've experienced.

For it is a great harmonic and very imminent journey where paths may cross. Kudos to those who hone their knowledge and leverage their skills as marching into the future would definitely require them.

A petrol company has bought new land away from the city. The company always prefers to put its buildings touching each other for confidential reasons. These buildings can be represented as cylinders, and each building should have the same height.

The manager has already decided on the locations of the first 2 buildings and the radius of one of them. However, he cannot figure out the possible locations for the third building, so he hired you as a professional programmer and a math geek. Can you tell him all the possible locations of the third building given its radius?

Input

The first line contains a single integer T denoting the number of test cases.

The first line of each test case contains two integers X_1, Y_1 $(0 \leq |X_1|, |Y_1| \leq 5 \times 10^5)$ denoting the coordinates of the first building.

The second line of each test case contains two integers X_2, Y_2 $(0 \leq |X_2|, |Y_2| \leq 5 \times 10^5)$ denoting the coordinates of the second building.

The third line of each test case contains a real number with exactly 3 decimal digits R_1 denoting the radius of the first building.

The fourth line of each test case contains a real number with exactly 3 decimal digits R_3 $(0 < R_3 < 5 \times 10^5)$ denoting the radius of the third building.

It is guaranteed that the given 2 buildings are touching each other.

Output

Print T lines.

The first line of each test case should contain the number of possible locations N where the third building can be built at.

Then, N lines follow. The i-th line contains the coordinates of one of the possible locations.

Your answer is considered correct if its absolute or relative error does not exceed 10^{-6}.

Example

story.in	standard output
2 0 3 6 0 2.500 5.500 1 1 5 5 1.414 2.000	2 4.527145587745 9.595828441323 -2.560375400411 -4.579213534990 2 -1.103624682219 3.688895534668 3.688895534668 -1.103624682219

Problem B. Begins and it

Input file:	begin.in
Output file:	standard output
Balloon Color:	White

Just like any story, it begins with an ambitious person, Conan. And as it moves forward, paths start to appear and connect. And as it takes two to Tango, Endure Capital, the ACPC Community Partner, believing in the relentless execution to build and achieve hyper-growth, starts investing in Conan's future journey.

Every triangle has 3 heights. The height is the perpendicular line that starts from one of the 3 vertices of the triangle and ends on the opposite side.

Conan gives you the triangle and asks you to get its maximum height.

Input

Each test contains multiple test cases. The first line contains the number of test cases T $(1 \leq T \leq 10^5)$. Description of the test cases follows.

Three lines for each test case denoting the 3 points that represent the triangle. Each line contains two integers X, Y $(-10^5 \leq X, Y \leq 10^5)$ that represents a point.

It is guaranteed that you will be given a valid triangle.

Output

For each test case, print the maximum height of the triangle.

Example

begin.in	standard output
2	4.00000000
0 0	301.79064443
0 3	
4 0	
-15 56	
288 52	
1 -151	

Note

Your answer will be considered correct if its absolute or relative error does not exceed 10^{-3}.

Problem C. Can look like a

Input file:	looklike.in
Output file:	standard output
Balloon Color:	Yellow

A deja vu is a French word expressing the feeling that one has lived through the present situation before. It seems that this story of the passionate Mashmosh can look like a story written by a different self in a different universe, yet something seems to be a bit different.

Mashmosh loves to fold and stick. Today he decided to do just that.

Mashmosh has N cubes lying in a line and numbered from 1 to N from left to right, with natural numbers written on them. he also has K stickers with exclamation marks. We know that the number of stickers does not exceed the number of cubes.

Mashmosh can stick an exclamation mark on the cube and get the factorial of the number written on the cube. For example, if a cube reads 5, then after the sticking it reads 5!, which equals 120.

You need to help Mashmosh count how many ways there are to choose some of the cubes and stick on some of the chosen cubes at most K exclamation marks so that the sum of the numbers written on the chosen cubes after the sticking modules W becomes equal to S. Mashmosh can stick at most one exclamation mark on each cube. Can you do it?

Two ways are considered the same if they have the same set of chosen cubes and the same set of cubes with exclamation marks.

Input

The first line of the input contain 4 integers N, K, W, S ($1 \le K \le N \le 20$) ,($1 \le W \le 10^7$) , ($1 \le S \le 10^4$).

Following by N integer the numbers written on the cubes from left to write ($1 \le number \le 10^5$)

Output

Output one integer the number of ways mentioned in the statement.

Examples

looklike.in	standard output
2 2 1 6 1 2	0
2 1 100 2 2 6	2

Problem D. Duplicated version but

Input file:	duplicated.in
Output file:	standard output
Balloon Color:	Silver

A deja vu is a French loanword expressing when one feels they have lived through the same situation in the past. It almost looked like a duplicated version and they certainly got us in the first part, but even when things look exactly similar ,the tiniest butterfly movement can make the whole difference.

KOKO gives you two integers (L, R) find the number of different values of 3 sides of non-degenerate triangles in the range [L,R], for example, if A, B, C are the values of sides of non-degenerate triangle find the number of different ways to satisfy this condition $(L \leq A \leq B \leq C \leq R)$.

Input

The first line contain one integer T $(1 \leq T \leq 80)$ the number of test cases.

In each test case tow integers L, R $(1 \leq L, R \leq 5 \times 10^3)$.

Output

For each test case print the answer as described in the problem statmen.

Example

duplicated.in	standard output
3 3 6 2 14 22 77	19 294 27133

Note

Problem E. Exceptionally different

Input file: `different.in`
Output file: standard output
Balloon Color: Red

Reading through others' lives, The Boss discovers that everything looks so familiar, yet everything is so exceptionally different. The Boss decides that for it being a great harmonic imminent journey, it is worth a little bit of a spoiler alert. But eventually, kudos to those who figure the story out. And as always Coach Academy, the ACPC Training Partner, jumps into the picture with training opportunities to provide guidance and lend a hand to The Boss through their big journey ahead.

The Boss gives you an integer N. Your task is to find the minimum number of perfect square numbers such that their summation equals N

The first five perfect squares numbers are (1, 4, 9, 16, 25 , 36 ...)

Input

The first line contains an integer $T(1 \le T \le 10)$ the number of Tests .

The second T line . each line contains one integer $(1 \le N \le 10^5)$

Output

Print T lines each line represent the minimum number of the perfect square for the i_{th} Test

Example

different.in	standard output
3 5 7 12	2 4 3

Note

First test

$N = 5 \implies 1 + 4$

$N = 7 \implies 1 + 1 + 1 + 4$

$N = 12 \implies 4 + 4 + 4$

Problem F. For it being a

Input file:	being.in
Output file:	standard output
Balloon Color:	Blue

It is the year 1808, and people are so excited about the newest inventions. Who could imagine we could speak with each other even if we are not in the same place. It is the new era for telephones. For it being so full of potentials, *Hussein* can't wait to pursue his goals and connect much better, as communications have never been easier.

Hussein books a train ticket, and this ticket have an integer *ID* number, *Hussein* doesn't know in which side he will set.

The train have **3 sides**, 2 of them is beside the window and the other one is in the middle of the train.

The chairs are numbered, look at the picture below..

Hussein needs your help to tell him where he will set.

- If he will set beside the window, tell him in which side, if he on the **Right** side tell him **"Right Window"**, else tell him **"Left Window"**.

- Else tell him that he won't be beside the window **"No Window"**.

Can you help him ?

Input

In the first line you will be given an integer *T* the number of test cases.

In the i_{th} line you will be given the *ID* of *Hussein*'s ticket.

Output

In the i_{th} line print where *Hussein* will set in the train.

Example

being.in	standard output
5	Left Window
1	No Window
2	Right Window
3	Left Window
6	Right Window
9	

Problem G. GREAT

Input file:	great.in
Output file:	standard output
Balloon Color:	Rose

What an eventful year, it's 1808, a year since Ahmed and Mohamed started their plan. The pursuit of one's goal has never been so fulfilling. As the impact is so rewarding. The great plan continues with the great support of the Arab Academy for Science and Technology (AAST), the ACPC headquarters. It is for sure, a base reason for establishing Ahmed and Mohamed future plans.

Ahmed and Mohamed decide to go to the cinema and want to sit next to each other, but it is possible that the reserved places do not allow that.

You are given the size of the cinema, which takes the shape of a rectangular grid of X rows and Y columns, and the number of reserved places and their location.

Calculate how many ways they can book two adjacent chairs.

Input

The first line contains an integer T representing the number of test cases.

In the first line of each test case, you get two integers X and Y ($1 \le X, Y \le 10^9$) — the number of rows and the number of columns in the cinema, respectively.

In the second line, you get an integer N ($0 \le N \le min(X \times Y, 3 \times 10^5)$) — the number of reserved seats.

In each of the next N lines, you get two integers A and B ($1 \le A \le X, 1 \le B \le Y$) that represent the reserved seat.

Output

For each test case, print one integer — the number of ways in which two adjacent chairs can be reserved.

Example

great.in	standard output
1 5 5 3 1 2 1 3 1 4	16

Problem H. Harmonic

Input file:	harmonic.in
Output file:	standard output
Balloon Color:	Black

A journey is never the end. It is always only a checkpoint that was completed if you really think about it. As one path comes to an end, it suddenly forks into many. Bomba was just there, their choice of the next move was everything harmonic for our story.

You are a good student and you get the full mark in your last exam so Bomba wants to give you a reward but first, you have to solve one problem for him.

He will give you an array A of N pairs (N is even), and you will have to choose exactly $N/2$ numbers from the first pair and $N/2$ from the second pair, but you can't use the same pair twice and you need to use all pairs.

Your task is to get the minimum sum you can get.

The sum is the summation of all numbers you have chosen.

Input

The first line contains the number of test cases T.

The first line of each test case contains only one integer N ($1 \leq N \leq 10^5$) — the array size.

Each of the next N lines contains two integers (A_{i1}, A_{i2}) ($1 \leq A_{i1}, A_{i2} \leq 10^9$) — the array of pairs.

Output

For each test case, output one integer — the minimum sum you can get.

Example

harmonic.in	standard output
1 2 1 3 2 5	5

Problem I. Imminent

Input file:	imminent.in
Output file:	standard output
Balloon Color:	Green

With the upcoming plans, Joey knows that crossing paths again with others' stories is imminent. They know that even if things appear to take the same turns, it is always different when you look up close and invest in seeing. Joey is very considerate to this when they plan their next move.

Joey and Mark are two extraordinary kids. They are used to watching maths courses instead of movies, eating πs instead of cakes, and even playing with numbers instead of playing football.

In one of their games, they get an array of integers and then take turns with Joey starting first. In each turn, one can select an integer A_i and divide it by another integer B such that $A_i \mod B = 0$ and B is a product of 2 or 3 primes (maybe the same prime).

Mark claims that this game's result can be known beforehand assuming both players play optimally, but Joey thinks that he is lying. Joey tells Mark that he might believe him if Mark tells him the correct result of the game if it is played on a subset of the array.

Mark is not a good programmer, so he asked you to write him a program to solve each game quickly and efficiently.

Input

The first line contains an integer T denoting the number of test cases.

The first line of each test case contains an integer N $(1 \leq N \leq 10^5)$ denoting the size of the array.

The second line of each test case contains N integers $A_1, A_2, \ldots, A_N$ $(1 \leq A_i \leq 10^7)$ representing the array.

The third line of each test case contains an integer Q $(1 \leq Q \leq 10^5)$ denoting the number of queries.

Then, Q lines follow. Each line contains 2 integers L and R $(1 \leq L \leq R \leq N)$ denoting the subset of the array.

It is guaranteed that the sum of N and Q over all test cases does not exceed 10^5 each.

Output

For every test case, print Q lines denoting the result of the i-th game if it is played over the i-th subset.

Example

imminent.in	standard output
1 5 1 2 4 6 8 5 2 4 2 5 3 5 1 4 1 5	Mark Joey Joey Mark Joey

Problem J. Journey

Input file:	journey.in
Output file:	standard output
Balloon Color:	Purple

Have you noticed yet? It's never been about the end of the journey. There is always what is coming next. It is about what happens throughout the journey with all the paths and turns. It is like an Arena, or to be more specific, a Talents Arena, the place where geeks just like Joey find what they have always been looking for!

Joey and Mark are two extraordinary kids. They are used to watching maths courses instead of movies, eating πs instead of cakes, and even playing with numbers instead of playing football.

Joey challenged Mark to solve a strange expression for different y:

$$z = x + \frac{y}{x}$$

Mark answered correctly all of Joey's questions, so Joey felt humiliated and changed his question. He will give Mark an array of integers and y, and then ask him to get the index i of the number x_i such that $z = x_i + \frac{y}{x_i}$ is maximum.

Joey also thought that this might be easy for Mark, so he asked him to solve different queries on different subsets of the array. Mark was overwhelmed by Joey's questions so he asked for your help.

Input

The first line contains an integer T denoting the number of test cases.

The first line of each test case contains an integer N ($1 \leq N \leq 2 \cdot 10^5$) denoting the size of the array.

The second line of each test case contains N integers $x_1, x_2, \ldots, x_N$ ($1 \leq x_i \leq 10^9$) denoting the numbers in the array.

The third line of each test case contains an integer Q ($1 \leq Q \leq 10^5$) denoting the number of queries.

The following Q lines represent the queries described as follows:

- 1 id x : This query means that you should change the number in index id ($1 \leq id \leq n$) into x ($1 \leq x \leq 10^9$).

- 2 L R y : The query means that you should get the index i ($L \leq i \leq R$) such that $z = x_i + \frac{y}{x_i}$ is maximum. The constraints are ($1 \leq L \leq R \leq N$) and ($0 \leq y \leq 10^{15}$).

It is guaranteed that the sum of N over all test cases does not exceed $2 \cdot 10^5$.
It is guaranteed that the sum of Q over all test cases does not exceed 10^5.

Output

Print the answers of each query of type 2 on separate lines.

Example

journey.in	standard output
1	2
5	4
1 2 3 4 5	2
4	
2 2 4 15	
2 1 4 3	
1 2 5	
2 2 4 15	

Problem K. Kudos to those who

Input file:	kudos.in
Output file:	standard output
Balloon Color:	Light Blue

KOKO is almost there. A new checkpoint in their story is over there. Kudos to those who seek it. KOKO definitely claims it.

KOKO gave Bomba an easy task, it's an integer N.

Bomba must break a given integer into at least two parts (nonnegative integers) so that the summation of these parts equals N his goal is to maximize the product of those parts.

Bomba solved this problem, can you solve it?

Input

The first line contains an integer $T (1 \leq T \leq 10^5)$ the number of Tests .

The second T line . each line contains one integer $(1 \leq N \leq 10^{18})$

Output

Print T lines each line represents the maximum product from i_{th} Test

Example

kudos.in	standard output
3	6
5	81
12	486
17	

Note

First test

$N = 5 \implies (3 + 2) -> 3 \times 2 = 6$

Problem L. Leverage their skill

Input file:	leverage.in
Output file:	standard output
Balloon Color:	Bronze

The future is certainly uncertain. But throughout the story, knowledge is gained. Building a book of wisdom, Bomba knows how to leverage their skill for one more chapter of the story of a lifetime from another verse.

Bomba wants to buy exactly N cakes, he can only buy one cake or two cakes per step.

If Bomba buys 2 cakes at one step he gets the third for free.

What's the minimum number of steps to buying exactly N cakes?

Input

The first line contains an integer T representing the number of test cases.

In each test case, you get one integer N ($1 \leq N \leq 100$)

Output

For each test case, output the minimum number of steps.

Example

leverage.in	standard output
4	1
1	2
2	2
6	3
7	