International Collegiate Programming Contest
the 2022 Al-Baath Collegiate Programming Contest (2022)
Syria
June 2022

The International Collegiate Programming Contest
Sponsored by ICPC Foundation

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(Contest Problems)

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Problem A. 2 Arrays Problem

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Black

You are given 2 arrays A and G both of the same length N. You are asked to create a permutation P of length N such that for any pair of integers i, j $(1 \leq i, j \leq n)$ where $i \neq j$ if $G_i = G_j$ and $A_i \geq A_j$ then it should satisfy that $P_i > P_j$.

Since there may be a lot of permutations that satisfy the above requirements, you are asked to print the lexicographically smallest permutation.

If there is no such permutation that satisfies the above requirements, print -1.

Input

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

The first line of each test case contains a single integer n $(1 \leq n \leq 10^5)$, the number of elements in each array.

The second line of each test case contains n integers $A_1, A_2, \ldots, A_n$ $(1 \leq A_i \leq 10^9)$, the elements of array A.

The third line of each test case contains n integers $G_1, G_2, \ldots, G_n$ $(1 \leq G_i \leq 10^5)$, the elements of array G.

The sum of n over all test cases doesn't exceed 10^5.

Output

Print T lines, each containing the lexicographically smallest permutation, or -1 if no such permutation exists.

Example

standard input	standard output
2 8 1 8 1 7 4 6 6 5 1 2 2 2 1 2 1 1 8 1 8 1 4 4 7 6 5 1 8 2 2 1 7 4 1	1 5 2 4 6 3 8 7 1 2 3 4 5 6 7 8

Note

For the second test case, we can check that the permutation satisfies the requirements.

- $A_1 < A_5$ and $G_1 = G_5 \implies P_1 < P_5$.
- $A_1 < A_8$ and $G_1 = G_8 \implies P_1 < P_8$.
- $A_5 < A_8$ and $G_5 = G_8 \implies P_5 < P_8$.
- $A_3 < A_4$ and $G_3 = G_4 \implies P_3 < P_4$.

Also, it's the lexicographically smallest permutation.

A permutation of length N is a sequence of integers from 1 to N of length N containing each number exactly once. For example, $[1], [4, 3, 5, 1, 2], [3, 2, 1]$ are permutations, and $[1, 1], [0, 1], [2, 2, 1, 4]$ are not.

Sequence $X_1, X_2, \ldots, X_N$ is lexicographically smaller than sequence $Y_1, Y_2, \ldots, Y_N$ if there exists an integer r $(0 \leq r < N)$ such that $X_1 = Y_1, X_2 = Y_2, \ldots, X_r = Y_r$ and $X_{r+1} < Y_{r+1}$.

Problem B. Too simple for a hard problem?

Input file: `standard input`
Output file: `standard output`
Balloon Color: Red

Ila has asked Ranreb to come up with a problem to put the set. What better problem can it be other than a simple problem with a short statement?

You will be given an array a, a weighted tree, and some queries. To make things a lot simpler, the array a will just be a permutation.

The queries are very simple:

"1 l r": Reverse $a[l \dots r]$. $(r - l + 1 \leq 30)$

"2 v k": v is a node in the tree. You will be given k (not necessarily disjoint) ranges, the i-th $(1 \leq i \leq k)$ range is $[l_i, r_i]$. You have to calculate:

$$OR_{i=1}^{k} \sum_{j=l_i}^{r_i} dist(a_j, v)$$

Where OR is bitwise OR and $dist(u, v)$ is the distance between u and v in the tree (i.e. the sum of weights of the edges on the simple path between u and v).

Input

In the first line of the input, you will be given an integer t $(1 \leq t \leq 10^5)$ — the number of testcases.

The first line of each testcase will contain two integers n and q $(1 \leq n, q \leq 10^5)$ — the number of nodes in the tree, and the number of queries, respectively.

In the next line there will be n integers $a_1, a_2, a_3, \dots, a_n$ $(1 \leq a_i \leq n)$. It is guaranteed that the array a is a permutation.

The next $n - 1$ lines will contain the edges of the tree. Each line will contain three integers u, v $(1 \leq u, v \leq n)$ and w $(0 \leq w \leq 10^3)$, which represents the endpoints and the weight of the edge, respectively. It is guaranteed that the given edges form a tree.

The next q lines will contain the description of the queries.

You will be given the queries in an encoded format. Let $prevAns$ be 0 initially.

For queries of the type 1, you will be given three integers on a single line. $type$, l, and r. Where $type$ will be equal to 1 for queries of this type, and $(1 \leq l \leq r \leq n,\ r - l + 1 \leq 30)$.

For queries of the type 2, on the first line of the query, you will be given three integers $type$, v', and k. Where $type$ will be equal to 2 for queries of this type, and $(1 \leq v' \leq n,\ 1 \leq k \leq 10^5)$. Then, the real value of v will be

$$v = (((v' \oplus prevAns) \cdot v') \mod n) + 1$$

Then follows k lines, each containing two integers l' and r' $(1 \leq l' \leq r' \leq n)$. Then, the real values of l and r will be

$$l = (((l' \oplus prevAns) \cdot l') \mod n) + 1$$
$$r = (((r' \oplus prevAns) \cdot r') \mod n) + 1$$

(where $\oplus$ is bitwise Exclusive OR).

If $r < l$, then swap them.

Then update the value of $prevAns$ to be equal to the answer to this query.

It is guaranteed that the sum of n over all testcases will not exceed 10^5, the sum of q over all testcases will not exceed 10^5, the sum of k over all the queries of the type 2 in the entire input file will not exceed 10^5.

Output

For each query of the type 2, output a line containing a single integer, the answer to that query.

Example

standard input	standard output
2 1 1 1 2 1 2 1 1 1 1 2 3 2 1 1 2 24 2 1 2 1 1 2 2 1 1 2 2 2 3 1 1 2 2 1 2	0 24 24

Note

Explanation of the second testcase from the sample:

In the first query, v is node 1, and the ranges are $[1, 1]$ and $[2, 2]$, The answer is $24 \ OR \ 0 = 24$.

$prevAns$ is now 24.

After the second query, the array becomes $[1, 2]$.

In the last query, v is node $(((2 \oplus 24) \cdot 2) \mod 2) + 1 = 1$, and the ranges are $[2, 2]$, $[1, 1]$, and $[1, 2]$. The answer is $24 \ OR \ 0 \ OR \ (0 + 24) = 24$.

Problem C. Basharo is not ugly

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Gold

let's define some concepts:

- Let **ugliness**(x) be the number of distinct prime factors of integer x.
- The **ugliness** of an array a is the sum of the ugliness of its elements.
- The **cost** of an array a is equal to the sum of its elements.

Now, you are given an integer array a and two integers $l, r (l \leq r)$ and you are asked to distribute the elements of this array between two arrays b and c where each element a_i must belong to exactly one of the arrays b or c.

A distribution is called valid if the ugliness of b is between l and r.

Among all the valid distributions of a, you must find the one that minimizes $|cost(b) - cost(c)|$.

Print the minimum value of $|cost(b) - cost(c)|$ you can get or print -1 if there's no valid distribution.

Input

The first line of the input contains a single integer T, $(1 \leq T \leq 20)$, the number of test cases.

Each test case consists of two lines. The first line contains three space-separated integers n, l, r $(1 \leq n \leq 100)$, $(1 \leq l \leq r \leq 55)$.

The second line contains n space separated integers $a_1, a_2, \ldots, a_n$ $(1 \leq a_i \leq 10^6)$.

It is guaranteed that the sum of n over all the test cases does not exceed 100 and that the sum of a_i over **each test case does not exceed** 10^6**.**

Output

For each test case, in a single line, if there's no valid distribution print -1 otherwise print the minimum possible value of $|cost(b) - cost(c)|$.

Example

standard input	standard output
3 6 2 4 1 1 2 2 2 2 6 1 6 1 1 1 1 1 1 6 1 6 2 2 2 2 2 2	0 -1 0

Note

In the first test case, we distribute a as follow: $b = 1, 2, 2$, $c = 1, 2, 2$.

The ugliness of b is 2 which is satisfy $l \leq 2 \leq r$.

The $cost(b) = 2, cost(c) = 2$ so the answer is $|2 - 2| = 0$ (the minimum possible answer).

Problem D. Ctrl+A+C+V

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Silver

We will create a new folder, and inside it, we will add a text file with the name S, then we will repeat the following n times:

1. Ctrl-A: Select all the files currently in the folder.
2. Ctrl-C: Copy all the selected files.
3. Ctrl-V: Paste the copied files in the same folder.

When the n steps are over, we will sort all the files by their names in lexicographical order.

The files will be renamed as follows:

All copied files will have $-$C0000 added to the end of their names when being pasted.

For a file is being pasted, if there is another file that has the same name, instead of adding $-$C0000 we increase the counter of this suffix to be $-$C0001, and if there is still a file sharing the same name we keep increasing the counter until there is no file that has the same name.

See notes for more clarification.

You have to print the name of the file whose index is k after sorting the renamed files, it is guaranteed that a solution exists for such k.

Input

The first line of the input contains one integer t ($1 \leq t \leq 10^3$) the number of test cases.

The first line of each test case contains a string S ($|S| \leq 10$) the initial filename. The second line of each test case contains two integers n ($1 \leq n \leq 10^3$), k ($1 \leq k \leq 10^{17}$) the number of times to copy all the files and the index of the file that you are asked its name.

It is guaranteed that k is less or equal to the number of files created after making n copies as demonstrated previously.

Output

For each test case print a single string F the filename at index k after sorting all the filenames in lexicographical order.

Example

standard input	standard output
2 Acm2022-23 2 1 Acm2022-23 2 2	Acm2022-23 Acm2022-23-C0000

Note

After the first copying operation, we will have the following files.

- `Acm2022-23`

- `Acm2022-23-C0000`

After the second copying operation, we will have the following files.

- `Acm2022-23`
- `Acm2022-23-C0000`
- `Acm2022-23-C0001`
- `Acm2022-23-C0000-C0000`

after sorting the files lexicographically:

- `Acm2022-23`
- `Acm2022-23-C0000`
- `Acm2022-23-C0000-C0000`
- `Acm2022-23-C0001`

So, for the first test case, the answer will be the first file name after the second copying operation which is `Acm2022-23`.

Problem E. Where is Naseem?

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Brown

In this contest, there is a superhero team with n contestants, one of them is Naseem, while the contest is running he wants to go out to smoke, and while he is out he wonders how many members of his team are still in the contest.

Input

The first line of input contains a single integer T ($1 \le T \le 10^5$), the number of test cases.

The next T lines each contains a single integer n ($1 \le n \le 10^5$), the number of contestants in Naseem's team.

Output

Print T lines, each containing a single integer, the number of members of his team that are still in the contest.

Example

standard input	standard output
2 3 7	2 6

Note

Explanation of the first sample case:

Naseem's team consists of 3 people (including Naseem). After he went out, only 2 of them are now left in the contest.

Problem F. Subgrid

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Green

Al-Aswad will give you a grid of size $n \times m$. Each cell (i, j) has an integer value $a_{i,j}$.

We will consider two cells as adjacent if they have a common side.

Your task is to choose a non empty subset of adjacent cells in such a way that the sum of cells' value is as large as possible.

Input

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

The first line of each test case contains two integers n $(1 \le n \le 10^3)$ and m $(1 \le m \le 9)$, the number of rows and the number of columns in the grid respectively.

The following n lines contain m integers each, the j-th element in the i-th line $a_{i,j}$ is the number written in the j-th cell of the i-th row $(|a_{i,j}| \le 10^5)$.

The sum of n over all test cases doesn't exceed 10^3.

Output

For each test case print a single line containing one integer, the answer to the problem.

Example

standard input	standard output
2 3 3 1 1 1 -1 -1 1 1 1 1 4 5 9 -6 -6 9 -2 6 4 -6 8 -9 8 -2 2 8 3 -6 4 6 2 5	7 72

Note

For the first test case, You can select adjacent cells $(1, 1), (1, 2), (1, 3), (2, 3), (3, 3), (3, 2), (3, 1)$. The sum of the values of these cells is 7.

For the second test case, you can select all cells with positive values and the cell $(3, 2)$, the sum will be: $27 - 2 + 47 = 72$. It can also be shown that this is the maximum possible sum.

Problem G. Little Fermat and digits sums

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Yellow

Little Fermat has recently learned about digits sum. He became super strong that he could solve any problem regarding the sum of digits. Unfortunately, one day he became bored and he started to think about the sum of squares of digits instead of boring simple digits sum. He found that some numbers have amazing properties so he started to call them beautiful numbers! A beautiful number is a natural number that has these two conditions:

1. it doesn't have any zero (0) digit. ($174, 3, 8955$ don't have any zero digits while $1058, 10, 600$ have at least one zero digits).

2. the sum of the squares of its digits is a perfect square.

A perfect square is an integer that is the square of an integer; in other words, it is the product of some integer with itself.

As Little Fermat became obsessed with these numbers he wants to find a way to generate a beautiful number with n digits.

Can you help Little Fermat?

Input

The first line of the input contains one integer T ($1 \le T \le 10^5$), the number of test cases.

The next T lines each contains a single integer n ($1 \le n \le 10^{16}$), the number of digits the beautiful number should have.

Output

You are Asked to find any beautiful number with n digits. if there is no such one print -1.

Since the number could be extremely large and the order of digits doesn't matter, you are asked to print 9 numbers, which represent the frequencies of the digits $1, 2, 3, 4, 5, 6, 7, 8, 9$ respectively.

Example

standard input	standard output
2 1 4	0 0 0 0 0 0 0 0 1 0 4 0 0 0 0 0 0 0

Note

In the first test case, 9 is a beautiful number with one digit. In the second test case 2222 is a beautiful number with four digits

Problem H. Kite

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Rose

Given an integer n, count the number of different kites in a regular n-gon.

A regular n-gon is a convex polygon consisting of n equal-length sides and all its angles are equal.

A kite is a convex quadrilateral $A\ B\ C\ D$, such that $AB = AD$ and $CB = CD$.

Two kites are considered different if they differ by at least one point.

Input

The first line of the input contains a single integer $T (1 \leq T \leq 2 \cdot 10^5)$ - the number of test cases.

Then T lines follow, each containing a single integer $n (4 \leq n \leq 10^9)$ - the number of sides of the polygon.

Output

For each test case, print a single line containing the number of different kites in a regular n-gon.

Example

standard input	standard output
2 4 5	1 0

Note

Explanation of the sample:

In the first testcase, the only kite is the whole 4-gon.

In the second testcase, there are no kites.

Problem I. Bombing buildings

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Orange

COVID-22 has spread in Aws's City. since humanity had suffered a lot from COVID-19, the army made a decision to destroy Aws's city.

Aws's City consists of n buildings lined up in a row from left to right, the height of the i-th building is h_i.

The army has two types of bombs.

- The first type of bombs can be used to destroy exactly one building with a cost of x
- The second type of bombs can be used to destroy a whole neighborhood with a cost of y.

A neighborhood is a segment (consecutive sequence) of buildings $[l, r]$ $(l < r)$ where $(h_l, h_r > 0)$ and h_r is the first building to the right of h_l greater than or equal to h_l (in other words, all buildings in the segment $[l + 1, r - 1]$ have heights less than h_l.

The army wants you to find the minimum cost to destroy all city buildings.

Input

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

The first line of each test case contains three integers n, x, and y $(1 \leq n \leq 500)$ $(1 \leq x, y \leq 10^9)$ the number of buildings in the city, the cost of destroying one building, and the cost of destroying a neighborhood respectively.

The second line of each test case contains n integers describing the height of each building in Aws's city from left to right where h_i $(1 \leq h_i \leq 10^9)$ is the height of building number i.

The sum of n over all test cases doesn't exceed 500.

Output

For each test case, print a single integer representing the minimum possible cost to destroy all buildings in the Aws's city.

Example

standard input	standard output
3 5 5 7 2 1 3 1 5 5 10 10 10 8 5 10 1 1 1 5 10	12 20 1

Note

For the 1-st test case: First, destroy the building with index 3 using the first bomb with cost x. The city will become like this [2 1 0 1 5]. Then, destroy a neighborhood from index 1 to index 5 with a cost of y. The total cost to destroy all the buildings = 1*x + 1*y.

For the 2-nd test case: First, destroy a neighborhood from index 1 to index 4 with cost y. The city will become like this [0 0 0 0 1] Then, destroy the last building using the first bomb with cost x. The total cost to destroy all the buildings = 1*x + 1*y.

For the 3-rd test case: The only way to destroy the only building in the city is by using the first bomb with cost x.

Problem J. Even Adjacent Product

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Light Blue

A permutation is an array consisting of n distinct integers from 1 to n in arbitrary order. For example, $[1, 2, 4, 3]$ is a permutation, but $[1, 3, 3, 2]$ is not a permutation because 3 appears twice in the array, and $[1, 2, 4, 5]$ is also not a permutation because $n = 4$ but there is 5 in the array.

Your task is to construct a permutation of length n, such that every pair of adjacent numbers in the permutation has an even product.

More formally, for each i $(1 \leq i < n)$, the following condition must hold:

- $(p_i \times p_{i+1})$ is even.

Input

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

The next T lines each contains a single integer $(1 \leq n \leq 10^5)$, the size of the permutation.

The sum of n over all testcases doesn't exceed 10^5.

Output

Print T lines, each containing a permutation of n space-separated integers such that every pair of adjacent numbers in the permutation has an even product. if there are multiple answers print any of them.

Example

standard input	standard output
2 6 12	2 1 6 5 4 3 2 9 8 7 4 5 6 1 12 3 10 11

Problem K. No Server? !Problem

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Purple

AbdulQader is a tech genius. he spent many years mastering the Art of Networking, so when he knew the SCPC needs volunteers for IT support, he signed in right away.

During the contest, a sudden error caused the server to crash. having no time to set up a new server, AbdulQader decides to connect every two computers *directly*.

The contest has n computers and a central switch of $\frac{n(n-1)}{2}$ connection points lined up in a row (numbered from 1 to $\frac{n(n-1)}{2}$). To connect any two computers *directly* you have to connect them to the same connection point. Each connection point can be connected to at most two computers.

The latency X_i of a computer i equals $X_i = p_e - p_s$ where :

- p_s $(1 \le p_s \le n)$ is the first connection point used by computer i.
- p_e $(1 \le p_e \le n)$ is the last connection point used by computer i.

AbdulQader knows that as *latency* gets bigger the connection gets slower, so he wants to connect computers in a way to make the sum of total *latency* for all the computers $\sum_{i=1}^{n} X_i$ as minimum as possible. Can you help him find that order?

Note that you have to connect each two exactly once.

Input

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

The next T lines each contains a single integer n $(2 \le n \le 500)$, the number of computers.

The sum of n over all test cases doesn't exceed 500.

Output

For each test case print $m = \frac{n(n-1)}{2}$ lines where the i^{th} line contain two integers a, b $(1 \le a, b \le n)$ which represents a connection between computers a and b at the connection point i.

Example

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

Note

We can connect: computers 1 and 2 at connection point 1, computers 2 and 3 at connection point 2, computers 1 and 3 at connection point 3, so that total *latency* $= 2 + 1 + 1 = 4$

Problem L. No Arithmetic subsequence

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Pink

Construct an $n \times n$ grid with numbers from 1 to $n \times n$ (each number exists exactly once) such that there is no row nor column that contains a subsequence (has exactly more than 2 elements) which forms an Arithmetic Progression.

Arithmetic Progression is a sequence of numbers in order, in which the difference between any two consecutive numbers is a constant value.

Input

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

The next T lines each contains a single integer n ($3 \leq n \leq 500$), the dimension of the grid.

The sum of n over all test cases doesn't exceed 500

Output

For each test case with input n print n lines each having n integers describing the required grid. It is guaranteed that there is always one solution at least. If there are multiple answers print any of them.

Example

standard input	standard output
1 3	1 3 2 7 9 8 4 6 5

Problem M. Mobile Game

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Dark Blue

Ali and Nour have decided to play a mobile game, the game will give an integer x to Ali and an integer y to Nour.

Each second, the game will print a number. It will print the numbers 1, 2, 3, $\ldots$ in that order.

For each number, either Ali can take that number and subtract it from x or Nour can take that number and subtract it from y.

The game ends when $x \le 0$ and $y \le 0$.

Since the battery of their device is running low, they want to finish the game as quickly as possible. Your task is to find the minimum number of seconds needed to finish the game.

Input

The first line of input contains a single integer T ($1 \le T \le 10^5$), the number of test cases.

The next T lines each contain two space-separated integers x and y ($1 \le x, y \le 10^{18}$) - the numbers given to Ali and Nour by the game.

Output

Print T lines, each containing a single integer, the minimum number of seconds needed to finish the game by making $x \le 0$ and $y \le 0$.

Example

standard input	standard output
2 4 7 6 4	5 4

Note

Explanation of the sample:

In the first test case, Ali will take 1, 2, and 3, then Nour will take 4 and 5, so they can finish the game in 5 seconds.

In the second test case, Nour will first take 1, then Ali will take 2, then Nour will take 3, and finally, Ali will take 4, so they can finish the game in 4 seconds.

Problem N. Moving grid

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	White

We got some leaks from the most dangerous place ever [Not Safe] that Baraa hates long statements.

So we decided not to write a story for this problem :D.

Given $N \times M$ points on a two dimensional-grid with coordinates $(x_i, y_j) = (a \times i, b \times j)$ where a,b are given integer values and for all possible pairs $i, j (1 \le i \le N, 1 \le j \le M)$.

Each second exactly one action will happen, either all points will move down simultaneously or they will move left simultaneously, and the action will happen randomly with a probability of $\frac{1}{2}$.

Points on-axis OX can't move down anymore even if the action was moving all points down, the same goes for points on axis OY that they can't move left if the action was moving all points left.

In other words, if the action is move down, all points with coordinates (x, y) where $(y > 0)$ will move to the position $(x, y - 1)$. And if the action is move left, all points with coordinates (x, y) where $(x > 0)$ will move to the position $(x - 1, y)$.

Note that More than one point can have the same coordinates at the same time.

When a point has a coordinate $(0, 0)$ it will disappear instantly.

K actions happened, and you are now asked the expected number of points that still exist on the grid.

Input

The first line contains one integer T, the number of test cases.

Each of the following T lines contains 5 integers N, M, a, b, K $(1 \le N, M, a, b \le 10^9, 0 \le K \le 2 \times 10^5)$ Where N, M determine the number of points in the grid, a, b determine the coordinates of the points and K represents the number of moves.

The sum of K over all test cases doesn't exceed $2 \cdot 10^5$.

Output

Print the expected number of points that still exist on the grid modulo $10^9 + 7$.

Formally, let $MOD = 10^9 + 7$. It can be demonstrated that the answer can be presented as an irreducible fraction $\frac{p}{q}$, where p and q are integers and $q \not\equiv 0 (\mod MOD)$.

Output a single integer equal to $(p \times q^{-1}) \mod MOD$. In other words, output an integer x such that $0 \le x < M$ and $x \times q \equiv p (\mod MOD)$.

Example

standard input	standard output
3 1 1 1 1 1 1 1 1 1 2 5 4 2 3 7	1 500000004 140625020