Problem A. Tokitsukaze, CSL and Palindrome Game

Input file: `standard input`
Output file: `standard output`

Tokitsukaze is playing with CSL a game based on a string $S_{1..n}$ which only contains lowercase letters and whose length is n.

A string is palindromic if and only if it reads the same backward as forward, such as "madam" and "racecar". Before the game starts, Tokitsukaze will select a palindromic substring of S, denoted as $S_{a..b}$, and CSL will select a palindromic substring, denoted as $S_{c..d}$, too.

There is also a string P that is empty at the beginning of the game. Then at every second, a character will be appended to the end of P automatically, where the character is randomly chosen from all possible lowercase letters (i.e. 'a' to 'z'), each with the same probability $\frac{1}{26}$. The game ends when both $S_{a..b}$ and $S_{c..d}$ become substrings of P.

Let $E(S_{a..b})$ be the expected length of P when $S_{a..b}$ **firstly** becomes a substring of P, and $E(S_{c..d})$ be the similar expected value for $S_{c..d}$. The winner of the game will be the one with a lower expected value for his or her choice. In case of a tie, when $E(S_{a..b})$ equals to $E(S_{c..d})$, the game is a draw.

Now, they will play this game with the same string S for q times, and Tokitsukaze will inform you of their choices in each game. Can you predict for her the result of each game?

Input

There are several test cases.

The first line contains an integer T $(1 \le T \le 25)$, denoting the number of test cases. Then follow all the test cases.

For each test case, the first line contains an integer n $(1 \le n \le 10^5)$, denoting the length of the string S.

The second line contains the string S consisting of only lowercase letters.

The third line contains an integer q $(1 \le q \le 10^5)$, denoting the number of games.

In the next q lines, each line contains four integers a, b, c and d $(1 \le a \le b \le n, 1 \le c \le d \le n)$, representing a game where Tokitsukaze selects $S_{a..b}$ and CSL selects $S_{c..d}$.

Output

For each game, output in one line "sjfnb" (without quotes, the same below) if Tokitsukaze will be the winner, or "cslnb" if CSL will, or "draw" in case of a tie. Note that the output characters are case-sensitive.

Example

<table>
<tr><th>standard input</th><th>standard output</th></tr>
<tr><td><pre>1
7
abbabba
5
1 1 2 2
1 4 4 7
2 3 1 7
1 4 5 6
2 3 3 5</pre></td><td><pre>draw
draw
sjfnb
cslnb
sjfnb</pre></td></tr>
</table>

Problem B. Lady Layton and Stone Game

Input file:	`standard input`
Output file:	`standard output`

Katori has many piles of stones, where there are a_i piles containing exactly i stones for $i = 1, 2, \ldots, n$.

Now, she wants to collect all these piles into one pile by merging one or more times. Each time she can pick k ($L \le k \le R$) piles and merge them into one, and the cost of that will be the number of stones in the new pile.

Can you help her find the best way to achieve that with the minimum possible total cost?

Input

There are several test cases.

The first line contains an integer T ($1 \le T \le 10$), denoting the number of test cases. Then follow all the test cases.

For each test case, the first line contains three integers n, L and R ($1 \le n \le 10^5, 2 \le L \le R \le \sum_{i=1}^{n} a_i$), denoting the maximum number of stones in each piles at the beginning, the lower bound and the upper bound of the number of piles she can merge at once, respectively.

The second line contains n integers, where the i-th integer is a_i ($1 \le a_i \le 10^5$), the number of piles containing exactly i stones at the beginning.

Output

For each test case, output in one line -1 if it is impossible for her to achieve the task, or otherwise the minimum total cost to finish that.

Example

standard input	standard output
4 1 2 2 2 3 2 2 1 1 1 3 2 3 1 1 1 4 3 3 1 1 1 1	2 9 6 -1

Note

For the first sample case, there are two piles $[1, 1]$ at the beginning. The best way is to merge $[1, 1]$ into $[2]$ directly, and the cost is 2.

For the second sample case, there are three piles $[1, 2, 3]$ at the beginning. The best way is to merge $[1, 2]$ into $[3]$ at first, and then merge $[3, 3]$ into $[6]$. The minimum total cost is $3 + 6 = 9$.

For the third sample case, there are three piles $[1, 2, 3]$ at the beginning. The best way is to merge $[1, 2, 3]$ into $[6]$ directly, and the cost is 6.

For the fourth sample case, there are four piles $[1, 2, 3, 4]$ at the beginning. Neither can she collect them into one pile directly nor by merging several times, so it is impossible for her to achieve the task.

Problem C. Tokitsukaze and Colorful Tree

Input file:	`standard input`
Output file:	`standard output`

Tokitsukaze has a rooted tree with n nodes, whose nodes are labeled from 1 to n and whose root is node 1. Furthermore, each node i has its own color col_i and its own weight val_i, where the color is labeled as a number between 1 and n, representing one of n given colors.

Here are two types of operation:

- 1 x v – set val_x as v.
- 2 x c – set col_x as c.

Tokitsukaze wants to execute q opeations and for $i = 1, 2, \ldots, q + 1$, after finishing the first $(i - 1)$ operations, she wants to know the value of

$$\sum_{\substack{1 \le u < v \le n \\ col_u = col_v \\ \text{node } u \text{ is not an ancestor of node } v \\ \text{node } v \text{ is not an ancestor of node } u}} (val_u \oplus val_v)$$

where $\oplus$ is the bitwise exclusive OR operation.

If you are not familiar with the bitwise exclusive OR, you may refer to https://en.wikipedia.org/wiki/Bitwise_operation#XOR and https://baike.baidu.com/item/xor/64178.

Input

There are several test cases.

The first line contains an integer T $(1 \le T \le 8)$, denoting the number of test cases. Then follow all the test cases.

For each test case, the first line contains an integer n $(1 \le n \le 10^5)$, denoting the number of nodes.

The second line contains n integers, where the i-th intger is col_i $(1 \le col_i \le n)$, denoting the color of node i at the beginning.

The third line contains n integers, where the i-th intger is val_i $(0 \le val_i < 2^{20})$, denoting the weight of node i at the beginning.

The next $(n - 1)$ lines describe the tree, where each line contains two integers u and v $(1 \le u, v \le n)$, representing an edge connecting node u and node v.

The next line contains an integer q $(0 \le q \le 10^5)$, denoting the number of operations.

The next q lines describe these operations in chronological order of occurrence, where each line contains three integers such that

- if the first integer is 1, then the following two integers are x and v $(1 \le x \le n, 0 \le v < 2^{20})$, representing an operation of the first type, or
- otherwise the first integer is 2, and the following two integers are x and c $(1 \le x, c \le n)$, representing an operation of the second type.

It is guaranteed that the size of the standard input file does not exceed 32 MiB, so you may need to use a fast approach to read the input data.

Output

For each test case, output $(q + 1)$ lines, where the i-th line contains an integer, denoting the value Tokitsukaze wants to know after the first $(i - 1)$ operations.

Example

standard input	standard output
1 5 1 1 1 1 1 1 2 4 8 16 1 2 3 1 2 4 2 5 2 1 3 32 2 3 2	62 146 24

Note

For the only sample case:

- before the first operation, the value is $(2 \oplus 4) + (4 \oplus 8) + (4 \oplus 16) + (8 \oplus 16) = 6 + 12 + 20 + 24 = 62$;
- before the second operation, the value is $(2 \oplus 32) + (32 \oplus 8) + (32 \oplus 16) + (8 \oplus 16) = 34 + 40 + 48 + 24 = 146$;
- after all the operations, the value is $8 \oplus 16 = 24$.

Problem D. Tokitsukaze and Multiple

Input file:	`standard input`
Output file:	`standard output`

Tokitsukaze has a sequence of length n, denoted by a.

Tokitsukaze can merge two consecutive elements of a as many times as she wants. After each operation, a new element that equals to the sum of the two old elements will replace them, and thus the length of a will be reduced by 1.

Tokitsukaze wants to know the maximum possible number of elements that are multiples of p she can get after doing some operations (or doing nothing) on the sequence a.

Input

There are several test cases.

The first line contains an integer T ($1 \le T \le 20$), denoting the number of test cases. Then follow all the test cases.

For each test case, the first line contains two integers n and p ($1 \le n, p \le 10^5$), denoting the length of the sequence and the special number, respectively.

The second line contains n integers, where the i-th integer a_i ($1 \le a_i \le 10^5$) is the i-th element of a.

It is guaranteed that the sum of n in all test cases is no larger than 10^6.

Output

For each test case, output in one line the maximum possible number of elements that are multiples of p after doing some operations.

Example

standard input	standard output
2 5 3 2 1 3 2 1 3 1 123 456 789	3 3

Problem E. Little W and Contest

Input file: `standard input`
Output file: `standard output`

There are n members in our ACM club. Little W wants to select three persons from our club to form a new team taking part in provincial ACM contests, as it is known by all of us that any ACM contest requires a normal team to have three members.

Little W has divided our club members into two role groups. The first group contains only readers who dedicate themselves to reading problems during contests, though sometimes they may also prepare drinking and food for the team. For the sake of measurement, we define the power of a reader as 1. The second part contains only coders who code and test programs all the time, and similarly, we define the power of a coder as 2.

Little W thinks it will be a tremendous disaster when a team has two readers because in that case, the total power of this team is less than 5 and thus it has a high risk to fail the contest. To avoid that, Little W thinks a new team must have at least two coders.

Additionally, Little W defines the relationship between club members with transitivity. That is, for every three members A, B, and C, if A is familiar with B, and B is familiar with C, then A will be familiar with C through B instantly. Based on the definition, it is forbidden for the team to have any two members familiar with each other.

At first, no member of our club is familiar with any other, and then Little W will repeatedly make an introduction between two members who are currently strangers to each other until each member is familiar with all the others. During this process, there will be exactly $(n-1)$ introductions.

Now, for $i = 1, 2, \ldots, n$, Little W wants you to count the combinations of three club members that can form a new team after the first $(i-1)$ introductions have been made. However, the numbers of combinations may be quite gigantic, so you just need to report each number in modulo $(10^9 + 7)$.

Input

There are several test cases.

The first line contains an integer T $(1 \leq T \leq 10)$, denoting the number of test cases. Then follow all the test cases.

For each test case, the first line contains an integer n $(1 \leq n \leq 10^5)$, denoting the number of members in this club.

The second line contains n integers consisting of only 1 and 2, where the i-th integer represents the power of the i-th member.

The next $(n-1)$ lines describe all introductions in chronological order of occurrence, where each line contains two integers u and v $(1 \leq u, v \leq n, u \neq v)$, representing an introduction between the u-th member and the v-th member, who are currently strangers to each other.

It is guaranteed that the sum of n is no larger than 10^6.

Output

For each test case, output n lines, where the i-th line contains an integer, denoting the number of combinations of three club members, in modulo $(10^9 + 7)$, that can form a new team after the first $(i-1)$ introductions have been made.

Example

standard input	standard output
1 5 2 2 2 1 1 4 5 1 4 2 1 3 2	7 7 3 0 0

Problem F. X Number

Input file: `standard input`
Output file: `standard output`

Teitoku loves many different kinds of numbers, and today Little W wants him to classify some positive integers into different categories.

There are 11 categories, numbered from 0 to 10. For each positive integer x, if there exists only one type of digit d ($0 \le d \le 9$) that occurs in x with the highest frequency, then we say x should be classified into category d, or otherwise, in case such digit doesn't exist, we say x should be classified into category 10.

For example,

- 111223 should be classified into category 1 since digit 1 occurs three times, and digits 2 and 3 occur less than three times respectively, and
- 3345544 should be classified into category 4 since digit 4 occurs three times, and digits 3 and 5 occur less than three times respectively, and
- 112233 should be classified into category 10 since digits 1, 2 and 3 occur twice respectively.

Little W doesn't care about category 10 and he just wants Teitoku to tell him the number of integers ranged from l to r that should be classified to another category d. However, Teitoku can hardly solve this problem, so he asks you for help.

Input

There are several test cases.

The first line contains an integer T ($1 \le T \le 1000$), denoting the number of test cases. Then follow all the test cases.

For each test case, the only line contains three integers l, r and d ($1 \le l \le r \le 10^{18}, 0 \le d \le 9$), representing a problem.

Output

For each test case, output in one line the number of integers ranged from l to r that should be classified to category d.

Example

standard input	standard output
3 1 10 1 1 11 1 1 100 0	1 2 1

Note

For the sample cases, 1 and 11 are in category 1, 100 is in category 0 and 10 is in category 10.

Problem G. Tokitsukaze and Rescue

Input file: `standard input`
Output file: `standard output`

Princess CJB has lived almost her entire life in the isolated town of Ertona, where CJB uses her unique ability to recognize where crystals of materials are buried. By way of a fateful encounter, CJB learns of the Alchemy Exam and decides to take her first step into the outside world, setting off on a grand journey to become a certified alchemist and discover the mysteries that life has to offer!

In order to take part in the Alchemy Exam, CJB goes to the Reisenberg town without any partners. But the kingdom Adalet is unbelievably enormous so that there are many hidden risks. Claris, a powerful evil magician, wants to monopolize CJB for the extraordinary beauty of her. Due to the power limitation of CJB, she can't escape from Claris without any assistance. The alchemist Tokitsukaze has heard this savage act and wants to rescue the princess CJB.

There are n cities numbered from 1 to n in the kingdom Adalet. Because of the excellent transportation, there is exactly a two-way road between any two cites. Tokitsukaze lives in city 1. The Magician Claris lives in city n. Since the exam will be held soon, Tokitsukaze wants to rescue CJB as fast as possible, so she will choose the shortest path to reach city n.

Claris has also heard this news and is afraid of being punished, so he decides to slow Tokitsukaze down by making an explosion on k roads he chose and causing these roads to lose their capability of two-way transportation, since it can pave the way for having enough time to prepare his powerful magic against Tokitsukaze.

Tokitsukaze knows some roads will be destroyed and can immediately recognize where they are, but she has no approach to prevent this explosion, so she chooses just to move along the shortest path after Claris completes his explosion.

Now Claris wants to know, after finishing his explosion, what the longest possible length is of the shortest path from city 1 to city n.

Input

There are several test cases.

The first line contains an integer T ($1 \le T \le 100$), denoting the number of test cases. Then follow all the test cases.

For each test case, the first line contains two integers n and k ($3 \le n \le 50, 1 \le k \le \min(n-2, 5)$), denoting the number of cities and the number of roads being exploded, respectively.

The next $\frac{n(n-1)}{2}$ lines describe all the roads, where each line contains three integers u, v and w ($1 \le u, v \le n, u \ne v, 1 \le w \le 10^4$), representing a two-way road of length w between city u and city v. It is guaranteed that for every two cities, there exists exactly one road whose length is randomly distributed between 1 and 10^4.

Output

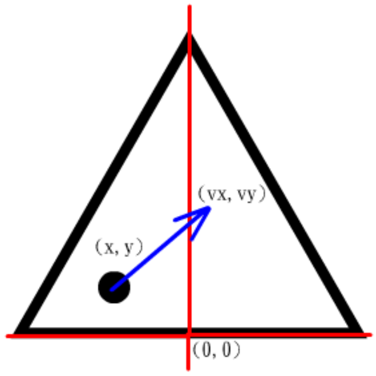
For each case, output in one line an integer, denoting the longest possible length of the shortest path after the explosion.

Example

standard input	standard output
3 5 1 1 2 2990 1 3 2414 1 4 4018 1 5 6216 2 3 9140 2 4 4169 2 5 550 3 4 6618 3 5 3206 4 5 105 5 2 1 2 2990 1 3 2414 1 4 4018 1 5 6216 2 3 9140 2 4 4169 2 5 550 3 4 6618 3 5 3206 4 5 105 5 3 1 2 2990 1 3 2414 1 4 4018 1 5 6216 2 3 9140 2 4 4169 2 5 550 3 4 6618 3 5 3206 4 5 105	4123 5620 6216

Problem H. Triangle Collision

Input file: `standard input`
Output file: `standard output`

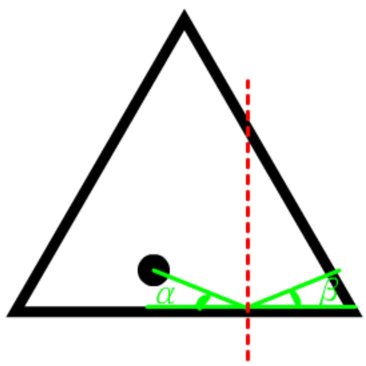


As depicted in the picture above, there is an extremely small ball inside the area enclosed by an equilateral triangular border whose side length is L. The radius of the ball is 10^{-1000}, which is so small that the ball can be treated as a point.

In order to clearly describe the position of the ball, we build a plane coordinate system based on this triangle. The original point is at the midpoint of the triangle's bottom edge, the X-axis is along with the bottom edge (from left to right), and the Y-axis is along with the height on the bottom edge (from bottom to top). For example, the vertices of the triangle are at the positions $\left(-\frac{L}{2},0\right)$, $\left(0,\frac{\sqrt{3}L}{2}\right)$ and $\left(\frac{L}{2},0\right)$ respectively.

At the beginning, the speed of the ball in the horizontal direction is v_x per second, and that in the vertical direction is v_y per second, in other words, the original speed of the ball is $\sqrt{{v_x}^2+{v_y}^2}$, along with the direction vector (v_x,v_y).

If the ball is now at the position (x,y), then it will move to the position $(x+t\cdot v_x, y+t\cdot v_y)$ after t seconds, if it does not touch the border during this process.

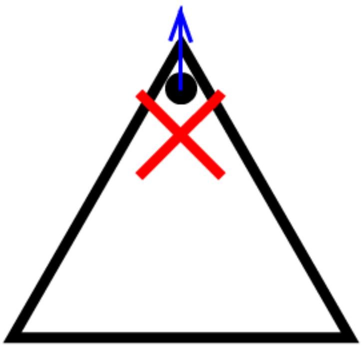


When the ball hits any edge of the border, a completely elastic collision occurs, which means the moving direction of this ball will change according to the law of reflection, but its speed will not.

The law of reflection follows the rule of "incident angle equals reflection angle". As depicted in the picture above, the incident angle α is equal to the reflection angle β.

Now given the side length L of this triangle, the ball's position (x,y) and its speed (v_x,v_y) at the beginning, can you calculate the time when the k-th collision occurs?

It is guaranteed that the ball does not touch any vertex of the triangle within the first k collisions.



But after the first k collisions, the ball may touch any vertex of the triangle, for example, in the third sample case.

The claim that the ball does not touch any vertex of the triangle means that the distances from the ball to the nearest two sides of the triangle will not equal to the ball's radius at the same time.

Input

There are several test cases.

The first line contains an integer T ($1 \le T \le 10^4$), denoting the number of test cases. Then follow all the test cases.

For each test case, the only line contains six integers L, x, y, v_x, v_y and k ($1 \le L \le 10^4, -10^4 \le x, y, v_x, v_y \le 10^4, 1 \le k \le 10^6$), representing a problem.

It is guaranteed for all test cases that the ball is strictly inside the triangle at the beginning, and as mentioned above, does not touch any vertex of the triangle within the first k collisions.

It is also guaranteed for all test cases that the speed of the ball is greater than 0.

Output

For each case, output in one line a real number, denoting the time when the k-th collision occurs.

For each output value, your answer is considered correct if its absolute or relative error does not exceed 10^{-4}. Formally, let your answer be a and the jury's answer be b, and then your answer is considered correct if $\frac{|a-b|}{\max(1,|b|)} \le 10^{-4}$.

Example

standard input	standard output
4 4000 0 1732 1000 0 1 4000 0 1732 1000 0 1000000 4000 0 1234 0 -1 1 4000 -1000 1 0 1000 925469	1.00002957 1999998.99997035 1233.99999975 1602959.32782988

Problem I. Parentheses Matching

Input file: `standard input`
Output file: `standard output`

Given a string P consisting of only parentheses and asterisk characters (i.e. “(”, “)” and “*”), you are asked to replace all the asterisk characters in order to get a balanced parenthesis string with the shortest possible length, where you can replace each “*” by one “(”, or one “)”, or an empty string “”.

A parenthesis string S is a string consisting of only parentheses (i.e. “(” and “)”), and is considered balanced if and only if:

- S is an empty string, or
- there exist two balanced parenthesis strings A and B such that $S = AB$, or
- there exists a balanced parenthesis string C such that $S = (C)$.

For instance, “”, “()”, “(())”, “()()”, “()(())” are balanced parenthesis strings.

Due to some notorious technical inability, if there are several solutions with the shortest possible length, then you have to report the smallest possible one in lexicographical order.

For every two different strings A and B of the same length n, we say A is smaller than B in lexicographical order if and only if there exists some integer k such that:

- $1 \le k \le n$, and
- the first $(k - 1)$ characters of A and that of B are exactly the same, and
- the k-th character of A is smaller than that of B.

For instance, “()(())” is smaller than “()()()”, and in this case, $k = 4$.

Input

There are several test cases.

The first line contains an integer T ($1 \le T \le 10^5$), denoting the number of test cases. Then follow all the test cases.

For each test case, the only line contains a string of length n ($1 \le n \le 10^5$), denoting the string P that consists of only parentheses and asterisk characters.

It is guaranteed that the sum of n in all test cases is no larger than 5×10^6.

Output

For each test case, output in one line “No solution!” (without quotes) if no solution exists, or otherwise the smallest possible solution in lexicographical order. Note that the output characters are case-sensitive.

Example

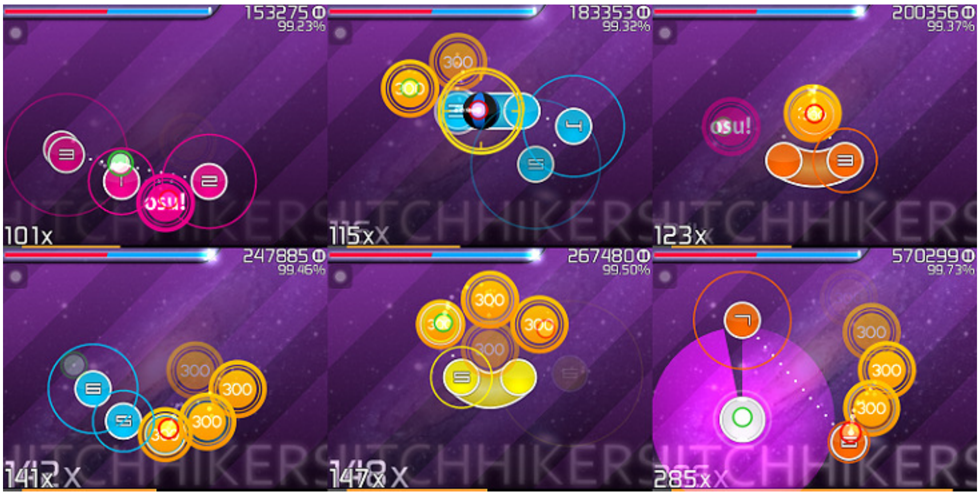
standard input	standard output
`5`	`No solution!`
`*))*)`	`()`
`*(*)*`	`()()`
`*)*(*`	
`******`	`(())()(())`
`((***)()((**`	

Problem J. Play osu! on Your Tablet

Input file: `standard input`
Output file: `standard output`

Little Q is an enthusiast of rhythm games, and recently he began to play **osu!** (standard mode) on his tablet.

In the game, his goal is to hit objects (circles, sliders, spinners, etc.) at the right time, and the more hits are perfectly timed, the more total score he gets. Additionally, since his tablet and this game support multi-finger control, he is able to play with two or more fingers. Here are a few snapshots of the game interface.



During his performance-enhancing play, he suddenly comes up with the following question:

There are several oncoming circles on the interface, whose perfect time to hit are pairwisely distinct, and Little Q wants to hit them at the right time using only two fingers. Besides, he wants to minimize the total cost of moving his fingers, where the cost of moving one finger between two circles is equal to the Manhattan distance between the centers of these two circles, and the total cost is the sum of costs for each finger.

Stunned by your excellent problem-solving capability, he would like to ask you to find the minimum total cost.

By the way, the Manhattan distance between two points (x_0, y_0) and (x_1, y_1) is defined as $|x_0-x_1|+|y_0-y_1|$, where $|p|$ is the absolute value of p.

For more details about **osu!**, you may refer to https://osu.ppy.sh/help/wiki/Main_Page.

Input

There are several test cases.

The first line contains an integer T $(1 \le T \le 1000)$, denoting the number of test cases. Then follow all the test cases.

For each test case, the first line contains an integer n $(1 \le n \le 10^5)$, denoting the number of oncoming circles.

The next n lines describe these circles in chronological order of occurrence, where the i-th line contains two integers x_i and y_i $(0 \le x_i, y_i \le 10^9)$, representing a circle with center (x_i, y_i).

It is guaranteed that the sum of n in all test cases is no larger than 3×10^5.

Output

For each test case, output in one line the minimum total cost.

Example

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

Problem K. Game on a Circle

Input file: `standard input`
Output file: `standard output`

There are n stones on a circle, numbered from 1 to n in the clockwise direction such that the next of the i-th stone is the $(i+1)$-th one $(i = 1, 2, \ldots, n-1)$ and the next of the n-th stone is the first one.

At the beginning of this game, all the stones exist. You will start from the first stone, and then repeatedly do the following operation until all the stones have been erased:

1. erase the current stone with probability p, and
2. move to the next stone that hasn't been erased in the clockwise direction.

Now your task is, for $i = 1, 2, \ldots, n$, to calculate the probability that the i-th earliest erased stone is the c-th one.

Due to the precision issue, you are asked to report the probabilities in modulo 998244353 ($2^{23} \times 7 \times 17 + 1$, a prime). For example, if the irreducible fraction of some output value is $\frac{x}{y}$, then you are asked to output the minimum possible non-negative integer z such that $x \equiv yz \pmod{998244353}$.

Input

There are several test cases.

The first line contains an integer T $(1 \le T \le 100)$, denoting the number of test cases. Then follow all the test cases.

For each test case, the only line contains four integers n, a, b and c $(1 \le c \le n \le 10^6, 0 < a < b < 998244353)$, representing that the number of stones is n, the probability p is $\frac{a}{b}$ and the special stone is the c-th one.

It is guaranteed that the sum of n in all test cases is no larger than 10^6.

It is also guaranteed that $(1-p)^i \not\equiv 1 \pmod{998244353}$ for $i = 1, 2, \ldots, n$ in each test case.

Output

For each test case, output n lines, where the i-th line contains an integer, denoting the probability, in modulo 998244353, that the i-th earliest erased stone is the c-th one.

Example

standard input	standard output
2 3 1 2 2 4 1 3 3	713031681 570425345 713031681 706449850 560148451 952979832 775154927

Note

For the first sample case, the irreducible fractions of the output values are $[2/7, 3/7, 2/7]$.

For the second sample case, the irreducible fractions of the output values are $[12/65, 356/1235, 333/1235, 318/1235]$.