Problem A: Littrain is a loser, in 2018

As we know, Littrain becomes a loser in 2018, for some reasons. He is very sad and wants to take a random walk at midnight in Beijing.

Littrain walks in a street. There are infinite houses in the street, numbered from $-\infty$ to $+\infty$. If Littrain is in front of house i now, the probability of that he will be in front of house $i+1$ or $i-1$ is $\frac{1}{4}$ and the probability of that he will stay in front of house i is $\frac{1}{2}$, at the next second.

At second 0, Littrain is in front of house 0. After t seconds, what's the probability of that he will be in front of house p?

Input

The first line of the input contains an integer T – the number of test cases ($T \leq 100$).

Each of the next T lines describes a test case and contains two integers t and p ($t, |p| \leq 10^5$).

Output

For each test case, you should output an integer – the probability mod 10^9+7, which means, if the probability equals to $\frac{a}{b}$, where $a, b \in \mathbb{N}$ and $gcd(a, b) = 1$, you should output an natural number $c < 10^9 + 7$, satisfying $bc \equiv a \pmod{10^9 + 7}$.

Examples

Input	Output
2 1 1 5 4	250000002 712890630

Problem B: Littrain wanna be strong

As we know, Littrain becomes a loser in 2018, for some reasons. He is very sad and wants to be strong. A strong man must be able to solve every problems, unfortunately he couldn't solve the problem below.

A *tree* is a graph consisting of n nodes and $n-1$ undirected edges in which any two nodes are connected by exactly one path. Give you a tree, in which each node has a value a_i. The value of a connected components is the sum of the value of all nodes in the connected components. What's the value of the i-th smallest connected component which contains the node 1? Please answer the question for $i \in [1, k]$.

Input

The first line of the input contains two integers n and k – the number of nodes in the tree and the number of asks ($1 \leq n, k \leq 10^5$).

The second line contains n integers a_i – the value of each node ($|a_i| \leq 10^9$).

The following $n-1$ lines contain two integers u_i, v_i – an edge of the tree ($1 \leq u_i, v_i \leq n$).

Output

You should output k lines, each line contains an integer $Answer_i$ – the value of the i-th smallest connected component which contains the node 1.

If the number of connected components which contain the node 1 is less than k, you needn't output k lines (see Examples).

Examples

Input	Output
5 100 1 2 -3 1 2 1 2 2 3 2 4 3 5	0 1 1 2 3 3 4

Problem C: Littrain wanna be different

As we know, Littrain becomes a loser in 2018, for some reasons. He is very sad and wants to be different from those winners.

A *tree* is a graph consisting of n nodes and $n-1$ undirected edges in which any two nodes are connected by exactly one path. Give you a tree, in which each node has a color c_i. Please find the smallest connected component which has at least k nodes whose colors are all different.

Input

The first line of the input contains two integers n and k – the number of nodes in the tree and the minimum number of different colors that the connected component should have ($1 \le n \le 10^4,\ 1 \le k \le 5$).

The second line contains n integers c_i – the color of each node ($1 \le c_i \le n$).

The following $n-1$ lines contain two integers u_i, v_i – an edge of the tree ($1 \le u_i, v_i \le n$).

Output

You should output an integer – the size of the smallest connected component that contains at least k different colors.

It's guaranteed that the input tree has at least one connected component satisfying the requirement.

Examples

Input	Output
5 3 1 4 4 2 3 1 2 2 3 3 4 2 5	3

Problem D: Littrain wanna be a tree

As we know, Littrain becomes a loser in 2018, for some reasons. He is very sad and wants to be a tree.

A *tree* is a graph consisting of n nodes and $n-1$ undirected edges in which any two nodes are connected by exactly one path. A *binary tree* is a tree in which each node has at most two children, which are referred as the left child and the right child. A $k-left\ tree$ is a binary tree in which any node except for the leaves has exactly two child and, the path from the root to each node passes less than k left children (the node that is the left child of its father, especially the root is considered as a left child too). Given n and k, please calculate the number of different $k-left\ tree$s which has i leaves for $i \in [1, n]$.

Input

The only line of the input contains two integers k and n ($n, k \leq 5000$).

Output

You should output n lines, each line contains an integer $Answer_i$ – the number of different $k-left\ tree$s which has i leaves (mod 10^9+9).

Examples

Input	Output
4 5	1 1 2 4 8
7 6	1 1 2 5 14 42

Problem E: Littrain wanna be small

As we know, Littrain becomes a loser in 2018, for some reasons. He is very sad and wants to be small.

To be small, Littrain wants you to help him determine an array $a_i \in \{-1, 1\}$ to minimize $|\sum_{i=1}^{n} a_i i^2|$.

Input

The first line of the input contains an integer T – the number of test cases ($T \leq 100$).

Each of the next T lines describes a test case and contains one integer n – you should minimize $|\sum_{i=1}^{n} a_i i^2|$ ($n \leq 10^6$).

It's guaranteed that the sum of n does not exceed 10^6 for all test cases combined.

Output

For each test case, the first line of your output should contain an integer – the minimum of $|\sum_{i=1}^{n} a_i i^2|$.

The second line should contain n integer a_i, where a_i equals to 1 or -1. If there are more than 1 answers, you can output any of them.

Examples

Input	Output
2 2 4	3 1 -1 2 -1 -1 -1 1

Problem F: Littrain wanna be white

As we know, Littrain becomes a loser in 2018, for some reasons. He is very sad and wants to be white.

A *tree* is a graph consisting of n nodes and $n-1$ undirected edges in which any two nodes are connected by exactly one path. A *binary tree* is a tree in which each node has at most two children, which are referred as the left child and the right child. A $fibonacci\ tree$ is a special binary tree in which each node has a white or black color, each white node (except for white leaves) has exactly one black child, each black node (except for black leaves) has exactly one white child and one black child, and the root is white. A special node pair is a pair of white nodes.

Given a fibonacci tree of depth n, please find the number of special node pairs in which the distance of the two nodes is i, for $i \in [1, 2n]$.

Input

The only line of the input contains an integer n ($n \leq 5000$) – the depth of the fibonacci tree.

Output

You should output a line containing $2n$ integers $Answer_i$ – the number of special node pairs in which the distance of two nodes is i (mod 123456789).

Examples

Input	Output
5	0 2 3 3 1 1 0 0 0 0

Problem G: Littrain wanna be winner

As we know, Littrain becomes a loser in 2018, for some reasons. He is very sad and wants to be winner, in an online game.

There are n characters in the game. Character i has three qualities a_i, b_i, c_i. Character i can beat character j if and only if at least two of these three conditions $a_i > a_j$, $b_i > b_j$ and $c_i > c_j$ are true.

Littrain first choose one character and fight with other characters one by one in any order. If he fights with character j and loses, he changes his character to j. After $n-1$ fights, the character he chooses is the winner. However, different first character and different fight order lead to different winner. Please find all characters that are possible to be winners.

Input

The first line of the input contains an integer n – the number of characters ($n \leq 10^5$).

The following n lines contain three integers a_i, b_i, c_i – the qualities of character i ($1 \leq a_i, b_i, c_i \leq n$).

It's guaranteed that a_i, b_i, c_i form three permutations of $\{1, 2, 3...n\}$.

Output

You should output n lines, each line contain an integer $Answer_i$ – if character i is possible to be a winner $Answer_i = 1$, otherwise $Answer_i = 0$.

Examples

Input	Output
3 1 3 2 2 1 3 3 2 1	1 1 1

Problem H: Littrain wanna be rich

As we know, Littrain becomes a loser in 2018, for some reasons. He is very sad and wants to be rich.

Littrain has n apples and wants to sell them to Eattrain and Fattrain. Eattrain wants to use a_i dollars to buy apple i, while Fattrain wants to use b_i dollars. Eattrain wants to buy at most A apples and Fattrain wants to buy at most B. An apple could only be bought by one train (aha, not person). What's the maximum number of dollars that Littrain can earn?

Input

The first line of the input contains three integers n, A and B ($A + B \le n \le 10^5$).

The second line contains n integers a_i ($|a_i| \le 10^5$).

The third line contains n integers b_i ($|b_i| \le 10^5$).

Output

You should output an integer – the maximum number of dollars that Littrain can earn.

Examples

Input	Output
5 2 3 1 1 -1 -1 2 1 1 2 2 3	9

Problem I: Littrain wanna be beautiful

As we know, Littrain becomes a loser in 2018, for some reasons. He is very sad and wants to be beautiful.

An positive integer X is beautiful if and only if, it satisfies that $10^i X \mod 10^n > X$ for $i = 1, 2...n-1$. Given n, how many beautiful integers there are?

Input

The first line of the input contains an integer T – the number of test cases ($T \leq 100$).

Each of the next T lines describes a test case and contains one integer n ($n \leq 10^9$).

Output

For each test case, you should output an integer – the number of beautiful integers (mod $10^9 + 7$).

Examples

Input	Output
3 2 3 7	45 330 1428570

Problem J: Littrain wanna go back to 2017

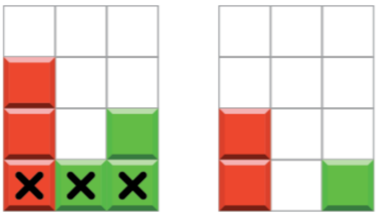
As we know, Littrain becomes a loser in 2018, for some reasons. He is very sad and wants to go back to 2017. A goddess named Aqua will help him travel back in time if he helps her win the 'Tetris' game.

The playing field is a rectangular vertical shaft, called the 'well' . Random figures of unit square blocks appear on top of the wall, the player chooses the horisontal position and rotation of the figure, after that the figure falls down in the well. The objective of the game is to create horizontal lines filled without gaps. When such a line is created, it disappears, and any blocks above the deleted line fall.

Because the great wisdom of Aqua, this version of 'Tetris' is quite difficult. The well size 4×3 units, and there are only three types of figures:

Type	Figure
1	
2	
3	

This picture may help you understand the meaning of the game better:



You lose if at some point there are five non-empty lines of the well. You win if you hadn't lost after figures have fallen.

Here comes n figures, help Aqua win the game.

Input

The first line of the input contains an integer n – the number of figures ($n \leq 1000$).

The second line contains n integers t_i – the type of figure i ($t_i \in \{1, 2, 3\}$).

Output

You should output n lines, each line contains two integers $a_i,\ b_i$ – the number of time the figure is rotated couter-clockwise and the position of the leftmost block of the figure, satisfying $a_i \in \{0, 1, 2, 3\},\ b_i \in \{0, 1, 2\}$. If there are more than 1 answers, you can output any of them.

Examples

Input	Output
4 1 3 3 2	0 0 0 0 2 1 1 2

Problem K: Littrain will be a winner, in 2018

As we know, Littrain has gone back to 2017, for some reasons. He is trying to solve the problem below again. If he succeeds, he will be a winner in 2018.

The *determinant* of a matrix can be defined by the Leibniz formula:

$$det(A) = \sum_{\sigma \in S_n} sgn(\sigma) \prod_{i=1}^{n} a_{i,\sigma_i}$$

where sgn is the sign function of permutations in the permutation group S_n, which returns +1 and -1 for even and odd permutations, respectively. The parity of a permutation σ can be defined as the parity of the number of pairs of elements x, y such that $x < y$ and $\sigma(x) > \sigma(y)$.

$\tau(n)$ equals to the number of factors of n, e.g., $\tau(4) = 3,\ \tau(6) = 4$. A is an $(n-1) \times (n-1)$ matrix in which $a_{i,j} = \tau(gcd(i+1, j+1))$. Given n, please calculate $det(A)$.

Input

The only line of the input contains an integer n ($2 \le n \le 10^{18}$).

Output

You should output an integer – $det(A)$ (mod $10^{18} + 7$).

Examples

Input	Output
2	2
233	145