Miserable Faith

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	128 megabytes

If faith has a color, it must be miserable red.

A tree is an undirected connected graph without cycles.

You are given a tree of n nodes numbered from 1 to n The root of the tree is a node number 1.

The color of i-th node is i.

For each node u and node v which are connected by an edge, the weight of edge is 1 if the color of node u is different from the color of node v otherwise the weight of edge is 0.

Let's denote path between node u and node v as (u, v).

Let's denote the number of edges in (u, v) as $d(u, v)$.

Let's denote the sum of weighted edges in (u, v) as $dist(u, v)$.

if u is an ancestor of v and v is an ancestor of w then u is an ancestor of w.

$v \in subtree(u)$ if u is an ancestor of v.

Let's denote $max_{i=1}^{n} d(i, u)$ as $FakeDeep_u$, while $dist(i, u) = 0$ and i is an ancestor of u.

There are m queries. Each query has one of four types:

1 u c: change the color of nodes in $(u, 1)$ to c, c is different from any other color in the tree.

2 u v: print $dist(u, v)$.

3 u: print $\sum_{i=1}^{n} dist(i, u), i \in subtree(u)$.

4 : print $\sum_{i=1}^{n} FakeDeep_i$.

Input

The first line contains an integer T $(1 \leq T \leq 10)$ representing the number of test cases.

For each test case, there are two integer n $(1 \leq n, m \leq 10^5)$ representing the number of nodes in the tree and the number of queries.

For next $n - 1$ lines, each line contain two numbers u, v, which means that there is an edge between u and v.

Each of the next m lines contains 1 or 2 or 3 integers:

1 u c $(1 \leq u \leq n, 1 \leq c \leq 10^6)$

2 u v $(1 \leq u, v \leq n)$

3 u $(1 \leq u \leq n)$

4

Output

For each query of type $2, 3, 4$, output the only line containing just one integer denoting the answer.

Example

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

String Mod

Input file:	`standard input`
Output file:	`standard output`
Time limit:	5.5 seconds
Memory limit:	256 megabytes

There are strings of length L consisting of the first k $(2 \le k \le 26)$ lowercase letters.The total number of strings is k^L.

For each pair(i, j)($0 \le i, j \le n-1$),please count the number of strings which contain p lowercase letters 'a' and q lowercase letters 'b', satisfying $p \equiv i \ (mod\ n)$ and $q \equiv j \ (mod\ n)$.

Print the matrix A,$A[i][j]$ is the answer of pair(i, j).

Input

The first line contains an integer $T(T \le 10)$. Then T test cases follow.

For each test case the first line contains three integers $k(2 \le k \le 26)$,$L(1 \le L \le 10^{18})$,$n(0 \le n \le 500)$.

Output

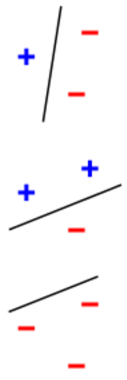
For each test case, output n lines contain n integers. which is the answer modulo $P = 10^9 + 9$,satisfying $n|(P-1)$. $\sum n \le 2000$.

Example

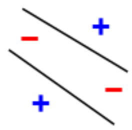
standard input	standard output
2 1 3	0 1 0 1 0 0 0 0 0

VC Is All You Need

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes



Three points example.



Four points example.

In this picture you can draw a line to seperate these 3 points in the two dimensional plane to keep points with the same color lie in the same side no matter how to color each point using either blue or red.

But in k dimensional real Euclidean space R^k, can you find n points satisfying that there always exsits a $k-1$ dimensional hyperplane to seperate them in any one of 2^n coloring schemes?

Input

The first line contains only one integer $T (1 \leq T \leq 10^5)$ denoting the number of test cases.

Each of next T liens contains two integers $n, k \in [2, 10^{18}]$ seperated by a space.

Output

Print Yes if you can find one solution, or print No if you cannot.

Example

standard input	standard output
3 2 2 3 2 4 2	Yes Yes No

Another String

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Define the distance between two strings of the same length as the numbers of the positions where the characters differ in these two strings.

If two strings of the same length has a distance of no more than k, we call these two string satisfy $k - matching$.

Given a string S of length n and a integer k. For each $i \in [1, n-1]$, split S into substrings A and B, while $A = S[1, i]$ and $B = S[i+1, n]$. For all the string pairs formed by some non empty substring of A and some non empty substrings of B, count the numbers pairs satisfying $k - matching$.

Input

The first line contains an integer T ($T \leq 60$), denoting the number of test cases.

For each test case, input two integers n ($2 \leq n \leq 3000$) and k ($0 \leq k \leq 3000$) for the first line.

The second line contains n characters denoting the string S.

Guarantee that S only contains lowercase letters and the sum of n is no more than 20000.

Output

For each test case, output $n - 1$ lines.

The i-th line contains only a integer denoting the number of the pairs for i.

Example

standard input	standard output
3 4 0 jslj 6 1 abcazz 5 0 zzzzz	1 1 1 5 9 10 8 5 4 8 8 4

Random Walk 2

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Penguin finds an directed complete graph with n vertices.

Notice that the graph has loops and no multiple edges.

Now he is going to walk on the graph randomly:

1.Suppose that he starts on the node S(now time $t = 1$).

2.Then every time he will go form node i to node j with $P[i][j] = \frac{W[i][j]}{\sum_{k=1}^{n} W[i][k]}$.

3.If he is on the node i at the time t and also on the node i at the time $t+1$,he will stay on node i forever.

Penguin wants you to help him calculate the probability $A[i][j]$ that he starts on node i and stops on node j.

Please compute $A[i][j]$ modulo 998244353.

Input

The first line contains an integer $T(T \leq 10)$. Then T test cases follow.

For each test case the first line of input contains integer $n \in [1, 300]$.

The ith of the following n lines contains n integers $W[i][j] \in [0, 10^5]$.

$\sum n \leq 2500$

Output

For each test case there are n lines.

The ith of n lines contains n integers $A[i][j]$ modulo 998244353.

[Sample 1 Explanation]

For node i there is a $\frac{1}{2}$ probability to stay on node i and a $\frac{1}{2}$ probability to leave node i .

So we can get

$$A = \begin{pmatrix} \frac{2}{3} & \frac{1}{3} \\ \frac{1}{3} & \frac{2}{3} \end{pmatrix}$$

Compute $A[i][j]$ modulo 998244353

$$A = \begin{pmatrix} 665496236 & 332748118 \\ 332748118 & 665496236 \end{pmatrix}$$

Examples

standard input	standard output
2 1 1 1 1	665496236 332748118 332748118 665496236
2 1 1 1 0	1 0 1 0

Cute Tree

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Given the pseudo-code of a function $Build - Tree(A, id, L, R)$:

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input: $Integer\ n,\ array\ a[1..n]$
output: $Integer\ tot$
  function $\text{BuildTree}(A[1..n], id, L, R)$
    $tot \leftarrow tot + 1$
    $id \leftarrow tot$
    if $L = R$ **then**
      $key_{id} \leftarrow A_L$
      return tot
    end if
    if $Len(L, R) = 1$ **then**
      // Len(L,R) return the length of [L,R]
      $mid \leftarrow \lfloor (L + R) \div 2 \rfloor$
      $\text{BuildTree}(A[1..n], son[id][0], L, L)$
      $//son[id][0/1/2]$ are the three sons of the node which number is id
      $\text{BuildTree}(A[1..n], son[id][1], R, R)$
    else
      $B \leftarrow L + \lceil len(L, R) \div 3 \rceil - 1$
      $C \leftarrow \lfloor (B + R) \div 2 \rfloor$
      C is the middle position of [B,R]
      $\text{BuildTree}(A[1..n], son[id][0], L, B)$
      $\text{BuildTree}(A[1..n], son[id][1], B + 1, C)$
      $\text{BuildTree}(A[1..n], son[id][2], C + 1, R)$
    end if
    for $i \in [1, R]$ **do**
      $key_{id} \leftarrow key_{id} + A_i$
    end for
  end function

---

where A is given in input, id is the number of node, L ,R is the left position and the right position of A

Require the number of nodes created by $Build - Tree(A, root, 1, n)$.

Input

The first line contains an integer T $(1 \leq T \leq 5)$ representing the number of test cases.

For each test case, the first contain one integer $n(1 \leq n \leq 2 * 10^5)$.

The second line contain n integers $A_i(1 \leq A_i \leq 10^9)$.

Output

For each test output one line, the number of nodes created by $Build - Tree(A, root, 1, n)$.

Examples

standard input	standard output
1 7 4 3 5 2 6 7 1	11
2 4 2 2 5 3 10 21 10 5 89 12 3 42 13 55 76	6 15

banzhuan

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Given a three-dimensional space of $[1, n] \times [1, n] \times [1, n]$. You're required to place some $1 \times 1 \times 1$ cubes to make this 3D space look $n \times n$ square from above, from left and from front, while the plane xOy stand for the ground and z axis describes the height.

But placing these cubes must follow some restrictions. Obviously, it must obey the gravity laws. It means, when beneath a cube is empty, the height of this cube will drop one, until its height is exactly 1 (touch the ground) or there is another cube below it.

And besides that, placing cubes has some prices. If a cube is placed at an integer coordinate (x, y, z), the price will be $x \times y^2 \times z$.

Now, satisfying all the requirements above, you're required to calculate the minimum costs and the maximum costs.

Input

The first line contains an integer $T (T \leq 15)$. Then T test cases follow.

For each test case, input a single integer n per line, while satisfying $1 \leq n \leq 10^{18}$.

Output

For each test case, output two lines. For the first line output the minimum costs $mod\ 10^9 + 7$. And for the second line, output the maximum costs $mod\ 10^9 + 7$.

Example

standard input	standard output
1	1 1

supermarket

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2.5 seconds
Memory limit:	256 megabytes

There were supermarkets in ancient times.

But stories in the ancient supermarkets were always forgotten by people.

The background of the story is like this:

There are n kinds of items and m shopping records in a contemporary supermarket.

Each shopping record tells us how many items a person bought for each kind at a certain time.

The manager of the supermarket wants to analyze m records and extract some rules.

People design many algorithms for this such as classical apriori algorithm.

A rule can be formulated as follows:

A person will buy all kinds of items in T with the high probability, in the condition that he has bought all kinds of items in the record S .

Your task is to extract useful rules for making more money.

One day, you find the task is so simple for you, so you decide to improve the difficulty.

Obviously, each shopping record may contain items of the same kind which aren't related for you to extract useful rules.

You plan to delete redundant information and keep the kinds for each shopping record.

In other words, all kinds of items in a record will be represented as a set A after removing repetitive items.

Now we uses an integer $A_i(A_i \in [0, 2^n))$ to stand for the i-th record which contains the kinds of items.

For example,$n = 4, A_i = (0101)_2$ means that the record contains the 1st kind of items and the 3rd kind of items.

Define $P(T|S)$ the probability that a person can get a shopping record containing T if he chooses one randomly from all records containing S in equal probability.

Notice that if there is no record containing S , then $P(T|S) = 0$ whatever T is.

For example,$P(\{"pen"paper"earser"\}|\{"book"pen"\})$ means the probability that a person buys pens,paper and earsers if he have bought books and pens. $P(\{"pen"paper"earser"\}|\{"book"pen"\}) = 0$ if there is no record containing $\{"book"pen"\}$.

Please compute

$$\sum_{S\in[0,2^n)} \sum_{T\in[0,2^n)} P(T|S)$$

modulo 998244353.

Input

The first line contains an integer $T(T \le 15)$. Then T test cases follow.

For each test case the first line contains two integers $n \in [1, 20]$,$m \in [1, 2 \times 10^5]$.

The i-th line of the following lines contains an integer $A_i \in [0, 2^n)$.

Output

For each test case print the answer modulo 998244353.

Example

standard input	standard output
3 5 7 6 5 3 5	66549669

Array

Input file:	`standard input`
Output file:	`standard output`
Time limit:	15 seconds
Memory limit:	512 megabytes

Given an integer array $a[1..n]$.

Count how many subsegment $[L, R]$ satisfying $R - L + 1 \geq 1$ and there is a kind of integer whose number of occurrences is strictly greater than the sum of others in $a[L..R]$.

Input

The first line contains an integer $T (T \leq 15)$. Then T test cases follow.

For each test case, input two lines.

For the first line, there is only one integer n $(1 \leq n \leq 10^6)$.

The second line contains n integers describing the array $a[1..n]$, while the restriction $0 \leq a_i \leq 10^6$ is guaranteed.

Output

For each test case, output a integer per line, denoting the answer of the problem.

Examples

standard input	standard output
1 1 96705	1
1 10 3 7 3 3 3 7 3 3 7 7	47

Guess Or Not 2

Input file:	`standard input`
Output file:	`standard output`
Time limit:	5 seconds
Memory limit:	256 megabytes

Bob has a generator which can generate a discrete probability distribution according to a given vector and a parameter.

This generator can be described as follows:

input: *number* k, *array* $x[1..k]$, *factor* t
output: *array* $y[1..k]$
function GENERATE($x[1..k], k, t$)
$sum \leftarrow 0$
for $i \in [1, k]$ **do**
$x_i \leftarrow \log(x_i)$
$z \leftarrow Rand(0, 1)$
// Rand(0,1) return a random real number uniformly
$z \leftarrow \log(z)$
$z \leftarrow -z$
$z \leftarrow \log(z)$
$z \leftarrow -z$
$x_i \leftarrow x_i + z$
$x_i = x_i/t$
$x_i = \exp(x_i)$
$sum \leftarrow sum + x_i$
end for
for $i \in [1, k]$ **do**
$y_i \leftarrow x_i/sum$
end for
return $y[1..k]$
end function

Now, given a vector $y[1..k]$, compute the probability density of the discrete probability distribution $y'[1..k]$ the algorithm output at the given vector $y[1..k]$. More specificly, compute the probability density $f_{GENERATE(x,k,t)}(y)$. Here, we see $GENERATE(x, k, t)$ as a random vector.

You should print the answers module 998244353.

Input

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

Each of the following T test cases begins with two integers k and t in the first line, k intergers x_i follow in the second line and k intergers z_i follow in the third line.

Here, you can compute y_i by $y_i = z_i / \sum_j z_j$.

Note that $\sum k \leq 10^6, k \in [2, 10^6], t, x_i, z_i \in [1, 998244353)$.

Output

For each test case, print the only integer in one line denoting the required probability density module 998244353.

Note that we guarantee the answers always exsit, i.e., $\sum z_i \ mod \ 998244353 \neq 0$.

Example

standard input	standard output
2 3 1 1 1 1 2 2 2 3 2 1 1 1 1 2 3	2 596788047

jsljgame

Input file: `standard input`
Output file: `standard output`
Time limit: 1 second
Memory limit: 256 megabytes

Jslj and Penguin like playing games very much. One day Jslj come up with a good idea.

There are n piles of stones, where the i-th pile has a_i stones.

Jslj and Penguin take alternating turns removing stones. Jslj goes first. In a move, Jslj can remove a positive number of stones except for x from any pile, Penguin can remove a positive number of stones except for y from any pile. The first player who can't make a move loses the game.

Your task is to determine who is winner.

Input

The first line contains an integer T $(1 \leq T \leq 2000)$ representing the number of test cases.

For each test case, the first contain three integers $n, x, y (1 \leq n \leq 10^3, 1 \leq x, y \leq 10^9)$ representing the number of piles, the number of stones Jslj can't remove, the number of stones Penguin can't remove.

The second line contain n integers $a_i (1 \leq a_i \leq 10^9)$, a_i is the number of stones in the i-th pile.

Output

For each test case, if Jslj wins, output Jslj. Otherwise, output yygqPenguin.

Example

standard input	standard output
1 3 20 100 5 800000 10	Jslj

Yet another matrix problem

Input file:	`standard input`
Output file:	`standard output`
Time limit:	4 seconds
Memory limit:	256 megabytes

There are two matrices A and B.

Matrix $A_{n,r}$ has n rows and r columns. Each $A[i][j]$ $(1 \le i \le n, 1 \le j \le r, 0 \le A[i][j] \le m)$ is an integer.

Matrix $B_{r,n}$ has r rows and n columns. Each $B[i][j]$ $(1 \le i \le r, 1 \le j \le n, 0 \le B[i][j] \le m)$ is an integer.

Define $f(x)$ as the number of pair$(A_{n,r}, B_{r,n})$ satisfying $C = A \times B$ *and* $\sum_{i=1}^{n}\sum_{j=1}^{n} C[i][j] = x$.

To simplify the problem, let $r = n^m$.

Now, you need to calculate $f(0), f(1)...f(m)$ *mod* 998244353.

Input

The first line contains an integer $T(T \le 15)$. Then T test cases follow.

For each test, input one single line with two integer $n,\ m \in [1, 10^5]$.

Output

For each test, output $m+1$ lines. For i-th line, print one integer, $f(i-1)$ *mod* 998244353.

Example

standard input	standard output
`2 1`	`49` `56`

penguin love tour

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1.5 seconds
Memory limit:	256 megabytes

Penguin loves driving. One day he found some islands, and wanted to go on a tour.

These n islands are connected by $n-1$ undirected roads, the i-th road connects island u_i, v_i take w_i to pass. Any two islands can reach each other. The i-th island has a power value p_i. You can do the following operations at most once for each island:

1. Choose a road that connects to the island

2. Change the cost of the road w to $max(0, w-p)$

The penguin will choose an island arbitrarily and follow the shortest path to another island. Since the penguin likes to travel long distances, he will choose the longest path from all possible options.But you don't want to make his journey too tiring. Can you reasonably allocate the power value of each island to make the penguin's travel as short as possible?

Input

The first line contains an integer $T(T \leq 1000)$. Then T test cases follow.

For each test case the first line contains one integer $n(1 \leq n \leq 10^5)$.

Then a line with n integers, $p_1, p_2, ..., p_n$ $(0 \leq p_i \leq 10^5)$ the power of the islands.

Then $n-1$ lines, each line containing three integers u_i, v_i, w_i $(1 \leq u_i, v_i \leq n, 1 \leq w_i \leq 10^5)$ describing a road.

It is guaranteed that $\sum n < 4 \times 10^5$.

Output

For each test case, print a line with an integer, representing the shortest travel length.

Examples

standard input	standard output
1 7 9 6 7 5 7 4 10 4 3 5 3 2 8 7 5 6 6 3 3 5 4 4 2 1 3	0
1 9 3 2 1 1 2 2 4 4 3 5 3 5 4 2 1 6 4 1 2 1 1 3 2 2 9 2 4 7 5 3 8 4 4	3