Problem A. Number Table

Time limit: 15 seconds
Memory limit: 256 Megabytes

The Spartan family is playing an early education number table game. The game is played on a table with two rows and n columns. Uncle Dante fills the first row, while Father Vergil fills the second row. They want Nero to calculate how many arrangements are possible so that the bitwise XOR sum of all the numbers is 0. Please note that the numbers in the table cannot be filled arbitrarily. Uncle Dante and Father Vergil can only fill nonnegative integers from the range $[0, 2^k)$ in each table cell. Moreover, there should be no repeated numbers in the same row or column. Now, they want to ask Nero how many possible arrangements exist to fill the table. Nero doesn't want to answer this question; he just wants to go and accompany Kyrie. He leaves the question for you to answer.

Input

The first line contains only one positive integer $T (1 \leq T \leq 10)$. which represents the number of test cases.
Next, there will be T lines, each containing two positive integers, n and k, where $1 \leq n \leq 40$ and $1 \leq k \leq 10000$.

Output

For each test case, output one line containing an integer representing the answer mod 998244353.

Example

standard input	standard output
4 1 1 2 1 2 2 3 3	0 2 36 8736

Problem B. Simple Tree Problem

Time limit: 20 seconds
Memory limit: 512 Megabytes

There is an undirected tree with n vertices and $n-1$ edges.
The i-th vertex has a positive integer value of $a_i(i = 1, 2, \ldots, n)$.
The i-th edge has a positive integer value of $k_i(i = 1, 2, \ldots, n-1)$.
We define $f(x, T)$ as the total number of vertices in tree T with value equal to x.
We define $g(y, T)$ as the maximum x that satisfies $f(x, T)$ is not less than y, if there is no x that satisfies the condition, then $g(y, T)$ is equal to 0.
For the i-th edge, **if** we remove it, the original tree will be divided into two new trees, denoted as T_{i_1} and T_{i_2}, respectively.
For the i-th edge, you need to calculate $\max(g(k_i, T_{i_1}), g(k_i, T_{i_2}))(i = 1, 2, \ldots, n-1)$.
Please note that for each edge, we will not really remove it.
Please pay attention to the time complexity of your program.

Input

Each test contains multiple test cases. The first line of input contains a single integer $t(1 \le t \le 10^6)$——the number of test cases. The description of test cases follows.
The first line of each test case contains a single integer $n(1 \le n \le 10^6)$ —— the number of vertices.
The second line of each test case contains n integers $a_i(1 \le a_i \le 10^9)$ —— indicating the value of each vertex.
The following $n-1$ lines of each test case contains three integers u_i,v_i and k_i $(1 \le u_i, v_i, k_i \le n, u_i \ne v_i)$ —— indicating an edge with value k_i between vertices u_i and v_i. It is guaranteed that the given edges form a tree.
It is guaranteed that the sum of n does not exceed 3×10^6.

Output

For each testcase, output $n-1$ lines, where the i-th line contains an integer representing the answer to the i-th edge.
Notes: In this problem, you may need more stack space to pass this problem. We suggest you to add the following code into your main function if you use C++.

```
int main() {
    int size(512<<20); // 512M
    __asm__ ( "movq %0, %%rsp\n"::"r"((char*)malloc(size)+size));
    // YOUR CODE
    ...
    exit(0);
}
```

And if you use the code above please **DON'T forget to add exit(0)**; in the end of your main function, otherwise your code may get RE.

Example

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

Problem C. Simple Set Problem

Time limit: 3 seconds
Memory limit: 256 Megabytes

Given k non empty multiple sets, each multiple set only contains integers with absolute values not exceeding 10^9.
It is required to select exactly one number from each multiple set to form an array $(a_1, a_2, \ldots, a_k)$ with a length of k.
Assuming $d = \max(a_1, a_2, \ldots, a_k) - \min(a_1, a_2, \ldots, a_k)$.Please calculate the minimum d.

Input

Each test contains multiple test cases.The first line of input contains a single integer $t(1 \le t \le 10^6)$——the number of test cases.The description of test cases follows.
The first line of each test case contains a single integer $k(1 \le k \le 10^6)$ —— the number of multiple sets.
The following k lines of each test case first read in a parameter c_i —— indicating the size of the i-th multiple set, followed by c_i integers with absolute values not exceeding 10^9 —— indicating the elements of the i-th multiple set.
Guarantee that $\sum_{i=1}^{k} c_i$ for each test case does not exceed 10^6, the sum of $\sum_{i=1}^{k} c_i$ for all test cases does not exceed 4×10^6.

Output

For each testcase, output an integer representing the answer, which is the minimum d.

Example

standard input	standard output
3 2 1 6 3 -7 7 10 4 9 -5 -9 2 8 5 4 3 3 8 2 10 8 1 -7 3 1 6 10 1 1 9	1 15 0

Problem D. Data Generation

Time limit: 1 seconds
Memory limit: 64 Megabytes

Yoshinow2001 is making data for his problem. He wants to generate a random permutation of $\{0, \ldots, n-1\}$, so he used the following algorithm:

Input: n, m

```
ans = 0
for i = 0 to n − 1 do
    a[i] = i
end for
for i = 1 to m do
    swap(a[rand() mod n], a[rand() mod n])
end for
for i = 0 to n − 1 do
    if a[i] ≠ i then
        ans = ans + 1
    end if
end for
```

Output: ans

Here, we can assume that the function **rand()** $\bmod n$ is able to generate integer randomly in the set $\{0, \ldots, n-1\}$ with equal probability.
Now Yoshinow2001 is concerned that this algorithm is not random enough —— after all, if you want to randomize a permutation, the expected number of elements for $a_i \neq i$ should be $n-1$. So he wants to ask what the mathematical expectation of the final ans is.

Input

The first line of input is a positive integer $T (1 \leq T \leq 10^5)$ representing the number of data cases.
For each cases consists of a single line of two integers n, m, separated by a space. Where $1 \leq n \leq 10^{18}$, $0 \leq m \leq 10^{18}$, ensure that n is not a multiple of 998 244 353.

Output

For each cases, output a line with a positive integer representing the answer mod 998 244 353.

Example

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

Problem E. Teyvat

Time limit: 8 seconds
Memory limit: 256 Megabytes

Yoshinow2001 has not logged in the GenshinImpact for a long time, and there are many more Dendroculus on the map of the Teyvat continent.
The map of the GenshinImpact can be seen as an **undirected connected graph** $G = (V, E)$ of n points, m edges, where each vertex $v \in V$ represents a location on the map, and each edge $e = (v_s, v_t)$ represents a road from the point v_s to v_t.
Since Yoshinow2001 has a lot of Dendroculus did not take, so he will give you a total of Q queries, each query indicates that there are k vertexs $\{a_1, a_2, \ldots, a_k\}$ on the graph G, these vertexs need to take Dendroculus. He wants to know how many vertex pairs (S, T) satisfy $1 \le S \le T \le n$ so that any simple path from S to T passes through all vertexs in the set $\{a_1, \ldots, a_k\}$ exactly once.

Input

Each test contains multiple test cases.The first line of input contains a single integer $T(1 \le T \le 1 \times 10^4)$—-the number of test cases.The description of test cases follows.
The first line contains three integers $n, m, Q(1 \le n \le 5 \times 10^5, 1 \le m, Q \le 1 \times 10^6)$ correspondingly represent the number of vertexs, the number of edges, the number of queries.
The following m lines contains two integers $u_i, v_i(u_i \ne v_i)$ indicating an undirected edge between u_i and v_i. It is guaranteed that $\forall i, j : 1 \le i < j \le m$ satisfy $(u_i, v_i) \ne (u_j, v_j)$.
The following Q lines. Each line begins with an integer k, representing the number of vertexs queried. Next k integers $a_1, \ldots, a_k$, representing the vertexs.
It is guaranteed that the sum of n for each test cases does not exceed 1.5×10^6, the sum of $m, Q, \sum_{i=1}^{Q} k_i$ for each test cases does not exceed 3×10^6.

Output

For each test case, output Q lines, where the i-th line contains an integer, representing the answer to the i-th query.
Notes: In this problem, you may need more stack space to pass this problem. We suggest you to add the following code into your main function if you use C++.

```
int main() {
    int size(512<<20); // 512M
    __asm__ ( "movq %0, %%rsp\n"::"r"((char*)malloc(size)+size));
    // YOUR CODE
    ...
    exit(0);
}
```

And if you use the code above please **DON'T forget to add exit(0)**; in the end of your main function, otherwise your code may get RE.

Example

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

Problem F. PSO

Time limit: 1 seconds
Memory limit: 64 Megabytes

Particle swarm optimization (PSO) is a population-based stochastic optimization algorithm. In addition to the basic structure of PSO, there is also a variant called star-topology PSO, which introduces a star-shaped communication structure among particles. In this structure, there is a central particle called the leader, which is responsible for gathering and disseminating information to the rest of the particles in the swarm.

Now there are n particles on the star-topology. Among the n particles, there is one particle as the leader, and there is an edge between the other particles and the leader. For a piece of information, it can be propagated along an edge on the topology.

To examine the benefits of this topology, we need to calculate the following data:

We define that X is number of edges required for them to exchange information for two different particles. Please calculate the expected value rounded off and maximum value of X.

Input

The first line of input is a positive integer $T(T \leq 10^5)$ representing the number of test cases. For each line,input a number $n(2 \leq n \leq 10^9)$.

Output

For each case, output two floating-point numbers representing the he expected value and maximum value of X. (keep 9 decimal places)

Example

standard input	standard output
2 4 7	1.500000000 2.000000000 1.714285714 2.000000000

Problem G. Guess

Time limit: 5 seconds
Memory limit: 128 Megabytes

Recently, Stump felt $\sum_{k=1}^{n} \mu^2(k) = \sum_{k=1}^{n} \mu(k) \lfloor \frac{n}{k^2} \rfloor$ with his heart immediately, which shocked Yoshinow2001 for a whole year!!
The above μ is **Möbius function** $\mu(n)$: If n contain square factor (i.e. there are positive integers $a > 1$ makes $a^2|n$) then the $\mu(n) = 0$. Otherwise, might as well set decomposition of prime factors of n type $n = p_1 \cdot p_2 \cdots \cdot p_k$, then $\mu(n) = (-1)^k$. For example, $\mu(1) = 1, \mu(2) = \mu(3) = -1$.
Recall that $\ln(n)$ denotes the logarithm of n with base $e = \sum_{n=0}^{\infty} \frac{1}{n!} \approx 2.71828$.
Now Yoshinow2001 is furious and pulls out a question! Let

$$S(n) = \sum_{d|n} \mu(\frac{n}{d}) \ln(d)$$

You need to calculate:

$$e^{S(n)} \bmod 998244353$$

Stump was horrified when he saw the formula! Now he asks you to feel it with your heart for him!

Input

The first line of input is a positive integer $T(1 \leq T \leq 2000)$ representing the number of test cases.
The next line has a total of T integers, each of which corresponds to n as described in the problem, where $1 \leq n \leq 10^{18}$.

Output

For each testcase, output an integer representing the answer mod 998244353, separated by a space.

Example

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

Problem H. String and GCD

Time limit: 16 seconds
Memory limit: 256 Megabytes

There is a string of length n which only contains lowercase letters.
$S[l:r]$ represents the string concatenated from the l -th character to the r -th character.
B is a boolean expression,the Iverson brackets

$$[B] = \begin{cases} 1, if\ B\ is\ true \\ \\ 0, otherwise \end{cases}$$

$\gcd(i,j)$ is the greatest common divisor of i and j.
We define $f(i) = \sum_{j=1}^{i-1}[S[1:j] == S[i-j+1:i]] \times \gcd(i,j)$.
Now ask for the value of $\prod_{i=1}^{n}(f(i)+1)$ modulo 998 244 353.

Input

The first line of input is a positive integer $T (T \leq 10)$ representing the number of test cases.
For each case,input a string S of lowercase letters, no longer than 10^6.

Output

For each case, output a line with a positive integer representing the answer.

Example

standard input	standard output
5 aaaaa aabaab abcdefghi abaabaaba abbabbabb	150 48 1 3840 1344

Problem I. WO MEI K

Time limit:	4 seconds
Memory limit:	256 Megabytes

There is a weighted tree with n vertices and $n-1$ edges. each edge has a value. Let $f(v,u)$ be the number of values that appear exactly once on the edges of a simple path between vertices v and u.
Now you randomly choose k vertices, which is $x_1, x_2, \dots, x_k$. For all $k = 1, 2, \dots, n$, calculate the expectation of $e_k = \sum_{i=1}^{k} \sum_{j=i+1}^{k} f(x_i, x_j)$ modulo 998244353

Input

This problem contains multiple test cases.The first line of input contains a single integer $t (1 \le t \le 2 \cdot 10^5)$—the number of test cases.The description of test cases follows.
In a test, the first line contains a single integer n $(2 \le n \le 2 \cdot 10^5)$ — the number of island
Each of the next $n-1$ lines contains three integers v, u and x $(1 \le v, u, x \le n)$ — This means that this egde connects u and v, and the value of this edge is x.
It's guarantee the sum of n over all test cases doesn't exceed 10^6.

Output

For each test case, print a single value $X = e_1 \oplus e_2 \oplus \dots \oplus e_n$, where the note $\oplus$ denotes XOR by bit.

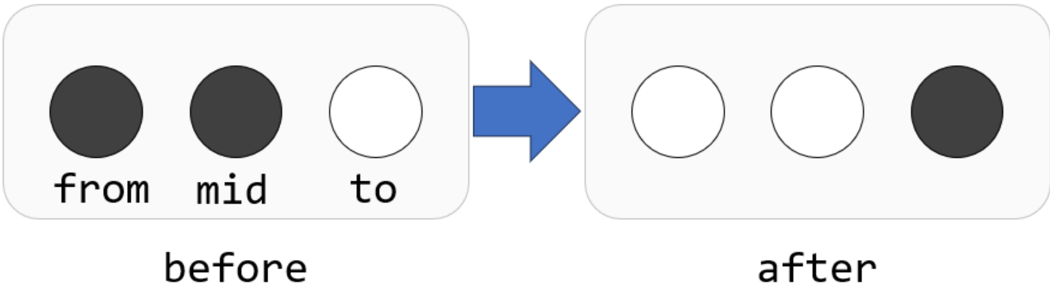
Example

standard input	standard output
2 2 1 2 1 3 1 2 1 1 3 2	1 332748115

Problem J. Kong Ming Qi

Time limit: 1 seconds
Memory limit: 64 Megabytes

According to legend, Kongming Chess is an intellectual game invented by Kongming during the Three Kingdoms period. In this problem, we make a slight modification to Kongming Chess. The game is played on an $(n + 2) \times (m + 2)$ chessboard, and there is one chess piece on each of the $n \times m$ positions in the middle of the chessboard.



The rules of Kongming Chess are as follows: Each time, you can choose one chess piece and then choose one of the four directions: up, down, left, or right. Move the chess piece one grid away in the chosen direction from its original position. In addition to the above requirement, the following conditions must be satisfied: There must be a chess piece on the intermediate position between the original position and the target position, and the target position must not have a chess piece. All positions must be on the chessboard.
After the move, the chess piece on the intermediate position is taken away. After each move, one chess piece will be removed from the chessboard. Now, we need you to solve a problem: Given n and m, what is the minimum number of chess pieces left on the chessboard?

Input

The first line contains a positive integer, T, where $1 \leq T \leq 100$, representing the number of query sets.
Next, there will be T lines, each representing a query. Each line contains two positive integers, n and m, where $1 \leq n, m \leq 65$.

Output

For each test case, output one line containing an integer representing the answer.

Example

standard input	standard output
2 1 2 2 3	1 2

Problem K. Circuit

Time limit: 5 seconds
Memory limit: 256 Megabytes

Now there is a directed graph $G = (V, E)$ with n vertices and m edges (the graph does not guarantee connectivity). You need to calculate the length of the circuit with the smallest length. At the same time, on this basis you also need to count the number of the circuit with the smallest length. There are no multiedges and self-loops in the graph.

Input

The first line of input is a positive integer $T(T \leq 15)$ representing the number of test cases. Description of the test cases follows:
The first line of each test case contains two integers n and m $(1 \leq n \leq 500, 0 \leq m \leq n \times (n-1))$—— the number of the vertices and edges in the given graph.
Each of the next m lines contains two integers u_i , v_i and w_i $(1 \leq u_i, v_i \leq n, 1 \leq w_i \leq 10^9)$meaning that there is a directed edge of length w_i between vertex u_i and vertex v_i in the tree.
The data guarantees that there will be no more than 10 groups with a value of n exceeding 100.

Output

For each case, output two integers representing the length and the number of the circuit with the smallest length. Since the number may be large, you need to output the result of modulating the answer to 998244353.Output -1 -1 if there is no circuit.

Example

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

Problem L. a-b Problem

Time limit: 3 seconds
Memory limit: 64 Megabytes

Alice and Bob are playing a little game. There are n stones. Alice and Bob take turns picking stones, with Alice going first. Each person can only pick one stone at a time until all the stones are gone. Each stone has two attributes, A_i and B_i. When Alice picks a stone, she earns A_i points, and when Bob picks a stone, he earns B_i points. The total score for each person is the sum of the points they earn when picking a stone. Both players want to maximize the difference between their scores, aiming to have their own score minus the opponent's score as large as possible. The question is, what is the final result of Alice's score minus Bob's score?

Input

The first line contains a positive integer, T, representing the number of test cases, where $1 \leq T \leq 20$.
Next, for each test case, the following format is repeated:
The first line contains a positive integer, n, where $1 \leq n \leq 10^5$. The next n lines contain two integers, A_i and B_i, representing the two attributes of the ith stone. The values of A_i and B_i satisfy $0 \leq A_i, B_i \leq 10^9$.

Output

For each test case, output one line containing an integer representing the answer.

Example

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