Problem A. Maximum Multiple

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	256 mebibytes

Given an integer n, Chiaki would like to find three positive integers x, y and z such that: $n = x + y + z$, $x \mid n$, $y \mid n$, $z \mid n$ and xyz is maximum.

Input

There are multiple test cases. The first line of input contains an integer T ($1 \le T \le 10^6$), indicating the number of test cases. For each test case:

The first line contains an integer n ($1 \le n \le 10^6$).

Output

For each test case, output an integer denoting the maximum xyz. If there no such integers, output -1 instead.

Example

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

Problem B. Balanced Sequence

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 mebibytes

Chiaki has n strings $s_1, s_2, \ldots, s_n$ consisting of '`(`' and '`)`'. A string of this type is said to be *balanced*:

- if it is the empty string
- if A and B are balanced, AB is balanced,
- if A is balanced, (A) is balanced.

Chiaki can reorder the strings and then concatenate them get a new string t. Let $f(t)$ be the length of the longest balanced subsequence (not necessary continuous) of t. Chiaki would like to know the maximum value of $f(t)$ for all possible t.

Input

There are multiple test cases. The first line of input contains an integer T, indicating the number of test cases. For each test case:

The first line contains an integer n ($1 \le n \le 10^5$) – the number of strings.

Each of the next n lines contains a string s_i ($1 \le |s_i| \le 10^5$) consisting of '`(`' and '`)`'.

It is guaranteed that the sum of all $|s_i|$ does not exceeds 5×10^6.

Output

For each test case, output an integer denoting the answer.

Example

standard input	standard output
2 1)()(()(2))(	4 2

Problem C. Triangle Partition

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 mebibytes

Chiaki has $3n$ points $p_1, p_2, \ldots, p_{3n}$. It is guaranteed that no three points are collinear.

Chiaki would like to construct n disjoint triangles where each vertex comes from the $3n$ points.

Input

There are multiple test cases. The first line of input contains an integer T, indicating the number of test cases. For each test case:

The first line contains an integer n ($1 \le n \le 1000$) – the number of triangle to construct.

Each of the next $3n$ lines contains two integers x_i and y_i ($-10^9 \le x_i, y_i \le 10^9$).

It is guaranteed that the sum of all n does not exceed 10^4.

Output

For each test case, output n lines contain three integers a_i, b_i, c_i ($1 \le a_i, b_i, c_i \le 3n$) each denoting the indices of points the i-th triangle use. If there are multiple solutions, you can output any of them.

Example

standard input	standard output
1 1 1 2 2 3 3 5	1 2 3

Problem D. Distinct Values

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	256 mebibytes

Chiaki has an array of n positive integers. You are told some facts about the array: for every two elements a_i and a_j in the subarray $a_{l..r}$ ($l \le i < j \le r$), $a_i \ne a_j$ holds.

Chiaki would like to find a lexicographically minimal array which meets the facts.

Input

There are multiple test cases. The first line of input contains an integer T, indicating the number of test cases. For each test case:

The first line contains two integers n and m ($1 \le n, m \le 10^5$) – the length of the array and the number of facts. Each of the next m lines contains two integers l_i and r_i ($1 \le l_i \le r_i \le n$).

It is guaranteed that neither the sum of all n nor the sum of all m exceeds 10^6.

Output

For each test case, output n integers denoting the lexicographically minimal array. Integers should be separated by a single space, and no extra spaces are allowed at the end of lines.

Example

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

Problem E. Maximum Weighted Matching

Input file:	*standard input*
Output file:	*standard output*
Time limit:	4 seconds
Memory limit:	256 mebibytes

Chiaki is good at generating special graphs. Initially, she has a graph with only two vertices connected by an edge. Each time, she can choose an edge (u, v), make a copy of it, insert some new vertices (maybe zero) in the edge (i.e. let the new vertices be $t_1, t_2, \ldots, t_k$, Chiaki would insert edges (u, t_1), (t_1, t_2), $\ldots (t_{k-1}, t_k)$, (t_k, v) into the graph).

Given a weighted graph generated by above operations, Chiaki would like to know the maximum weighted matching of the graph and the number different maximum weighted matchings modulo $(10^9 + 7)$).

A matching in a graph is a set of pairwise non-adjacent edges, none of which are loops; that is, no two edges share a common vertex.

A maximum weighted matching is defined as a matching where the sum of the values of the edges in the matching have a maximal value.

Input

There are multiple test cases. The first line of input contains an integer T, indicating the number of test cases. For each test case:

The first line contains two integers n and m ($1 \le n, m \le 10^5$) – the number of vertices and the number of edges.

Each of the next m lines contains three integers u_i, v_i and w_i ($1 \le u_i, v_i \le n, 1 \le w_i \le 10^9$) – deonting an edge between u_i and v_i with weight w_i.

It is guaranteed that neither the sum of all n nor the sum of all m exceeds 10^6.

Output

For each test case, output two integers separated by a single space. The first one is the sum of weight and the second one is the number of different maximum weighted matchings modulo $(10^9 + 7)$.

Example

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

Problem F. Period Sequence

Input file:	*standard input*
Output file:	*standard output*
Time limit:	6 seconds
Memory limit:	256 mebibytes

Chiaki has n integers $s_0, s_1, \ldots, s_{n-1}$. She has defined an infinite sequence S in the following way: $S_k = s_{k \bmod n} + n \cdot \lfloor \frac{k}{n} \rfloor$, where k is a zero based index.

For a continuous subsequence $S[l..r]$, let cnt_x be the number of occurrence of x in the subsequence $S[l..r]$. Then the value of $S[l..r]$ is defined as follows

$$f(l, r) = \sum_x x \cdot cnt_x^2$$

For two integers a and b ($a \le b$), Chiaki would like to find the value of

$$\left(\sum_{a \le l \le r \le b} f(l, r) \right) \bmod (10^9 + 7)$$

Input

There are multiple test cases. The first line of input contains an integer T, indicating the number of test cases. For each test case:

The first line contains three integers n, a and b ($1 \le n \le 2000, 0 \le a \le b \le 10^{18}$).

The second line contains n integers $s_0, s_1, \ldots, s_{n-1}$ ($0 \le s_i \le 10^9$).

It is guaranteed that the sum of all n does not exceed $2 \cdot 10^4$.

Output

For each test case, output an integer denoting the answer.

Example

standard input	standard output
4 3 2 6 2 1 3 5 2 7 2 1 5 1 2 4 4 8 2 1 5 17 3 5 9 2 5 2	179 268 369 437

Problem G. Chiaki Sequence Revisited

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 mebibytes

Chiaki is interested in an infinite sequence $a_1, a_2, a_3, \ldots$, which is defined as follows:

$$a_n = \begin{cases} 1 & n = 1, 2 \\ a_{n-a_{n-1}} + a_{n-1-a_{n-2}} & n \geq 3 \end{cases}$$

Chiaki would like to know the sum of the first n terms of the sequence, i.e. $\sum_{i=1}^{n} a_i$. As this number may be very large, Chiaki is only interested in its remainder modulo $(10^9 + 7)$.

Input

There are multiple test cases. The first line of input contains an integer T ($1 \leq T \leq 10^5$), indicating the number of test cases. For each test case:

The first line contains an integer n ($1 \leq n \leq 10^{18}$).

Output

For each test case, output an integer denoting the answer.

Example

standard input	standard output
10 1 2 3 4 5 6 7 8 9 10	1 2 4 6 9 13 17 21 26 32

Problem H. RMQ Similar Sequence

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	256 mebibytes

Chiaki has a sequence $A = \{a_1, a_2, \ldots, a_n\}$. Let $\mathbf{RMQ}(A, l, r)$ be the minimum i ($l \le i \le r$) such that a_i is the maximum value in $a_l, a_{l+1}, \ldots, a_r$.

Two sequences A and B are called *RMQ Similar*, if they have the same length n and for every $1 \le l \le r \le n$, $\mathbf{RMQ}(A, l, r) = \mathbf{RMQ}(B, l, r)$.

For a given the sequence $A = \{a_1, a_2, \ldots, a_n\}$, define the weight of a sequence $B = \{b_1, b_2, \ldots, b_n\}$ be $\sum_{i=1}^{n} b_i$ (i.e. the sum of all elements in B) if sequence B and sequence A are RMQ Similar, or 0 otherwise. If each element of B is a real number chosen independently and uniformly at random between 0 and 1, find the expected weight of B.

Input

There are multiple test cases. The first line of input contains an integer T, indicating the number of test cases. For each test case:

The first line contains an integer n ($1 \le n \le 10^6$) – the length of the sequence.

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le n$) denoting the sequence.

It is guaranteed that the sum of all n does not exceed 3×10^6.

Output

For each test case, output the answer as a value of a rational number modulo $10^9 + 7$.

Formally, it is guaranteed that under given constraints the probability is always a rational number $\frac{p}{q}$ (p and q are integer and coprime, q is positive), such that q is not divisible by $10^9 + 7$. Output such integer a between 0 and $10^9 + 6$ that $p - aq$ is divisible by $10^9 + 7$.

Example

standard input	standard output
3 3 1 2 3 3 1 2 1 5 1 2 3 2 1	250000002 500000004 125000001

Problem I. Lyndon Substring

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3 seconds
Memory limit:	256 mebibytes

A string w is said to be a Lyndon word if w is lexicographically smaller than any of its cyclic rotations.

The longest Lyndon substring of a string s is the longest substring of s which is a Lyndon word.

Chiaki has n strings $s_1, s_2, \ldots, s_n$. She has some queries: for some pair (i, j), find the length of the longest Lyndon substring of string $s_i s_j$.

Input

There are multiple test cases. The first line of input contains an integer T, indicating the number of test cases. For each test case:

The first line contains two integers n and m ($1 \le n, m \le 10^5$) – the number of strings and the number of queries.

Each of the next n lines contains a nonempty string s_i ($1 \le s_i \le 10^5$) consisting of lowercase English letters.

Each of the next m lines contains two integers i and j ($1 \le i, j \le n$) denoting a query.

It is guaranteed that in one test case the sum of all $|s|$ does not exceed 5×10^5 and that in all cases the sum of all $|s|$ does not exceed 5×10^6.

It is guaranteed that neither the sum of all n nor the sum of all m exceeds 10^6.

Output

For each query, output an integer denoting the answer.

Example

standard input	standard output
1 2 1 aa bb 1 2	4

Problem J. Turn Off The Light

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	256 mebibytes

There are n lights aligned in a row. These lights are numbered 1 to n from left to right. Initially some of the lights are turned on. Chiaki would like to turn off all the lights.

Chiaki starts from the p-th light. Each time she can go left or right (i.e. if Chiaki is at x, then she can go to $x-1$ or $x+1$) and then press the switch of the light in that position (i.e. if the light is turned on before, it will be turned off and vise versa).

For each $p = 1, 2, \ldots, n$, Chiaki would like to know the minimum steps needed to turn off all the lights.

Input

There are multiple test cases. The first line of input is an integer T indicates the number of test cases. For each test case:

The first line contains an integer n ($2 \le n \le 10^6$) – the number of lights.

The second line contains a binary string s where $s_i = 1$ means the i-th light is turned on and $s_i = 0$ means i-th light is turned off.

It is guaranteed that the sum of all n does not exceed 10^7.

Output

For each test cases, output $(\sum_{i=1}^{|s|} i \times z_i) \bmod (10^9+7)$, where z_i is the number of step needed when Chikai starts at the i-th light.

Example

standard input	standard output
3 3 000 3 111 8 01010101	0 26 432

Problem K. Time Zone

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 mebibytes

Chiaki often participates in international competitive programming contests. The time zone becomes a big problem.

Given a time in Beijing time (UTC +8), Chiaki would like to know the time in another time zone s.

Input

There are multiple test cases. The first line of input contains an integer T ($1 \le T \le 10^5$), indicating the number of test cases. For each test case:

The first line contains two integers a, b ($0 \le a \le 23, 0 \le b \le 59$) and a string s in the format of "`UTC+X`", "`UTC-X`", "`UTC+X.Y`", or "`UTC-X.Y`" ($0 \le X, X.Y \le 14$).

Output

For each test, output the time in the format of $hh : mm$ (24-hour clock).

Example

standard input	standard output
3 11 11 UTC+8 11 12 UTC+9 11 23 UTC+0	11:11 12:12 03:23