Problem K. Reverse KMP

Time limit: 1 second
Memory limit: 256 megabytes

In the KMP algorithm, the next array (also known as the LPS array, for Longest Prefix Suffix, or the failure function) is a core concept. Given a string $S = s_1 s_2 ... s_n$ of length n, its next array next[1..n] is defined such that next[i] represents the length of the longest equal proper prefix and proper suffix of the substring $S[1..i]$, specifically, next[1] = 0. Formally, it is defined as:

$$next[i] = \max_{k=0,\ldots,i-1} \{k : S[1 \ldots k] = S[i-k+1 \ldots i]\}$$

Here, $S[l..r]$ is defined as the substring formed by the l-th character to the r-th character of the string S. It is considered that $\forall 1 \le i \le n,\ S[1...0] = S[i+1...i]$, both of which are empty strings.

Given an array $A[1..n]$ of length n. You need to count how many different strings S of length n defined over the character set Σ have a next array that is exactly equal to the given array A. The size of the character set is m. Output the number of such strings modulo 998 244 353.

Input

There are multiple test cases in a single test file. The first line of the input contains a single integer T ($1 \le T \le 10^5$), indicating the number of test cases.

For each test case:

- The first line contains two integers n ($2 \le n \le 10^5$) and m ($1 \le m \le 10^6$) representing the length of the given array and the size of the character set.
- The second line contains n integers, separated by spaces, representing the given array A. It is guaranteed that $\forall 1 \le i \le n, 0 \le A_i \le i-1$.

It is guaranteed that the total sum of n does not exceed 5×10^5, i.e., $\sum n \le 5 \times 10^5$.

Output

For each test case, output a single line with a single integer, representing the number of strings that satisfy the conditions, with the answer taken modulo 998 244 353.

Example

standard input	standard output
3 3 3 0 1 2 7 3 0 0 0 1 2 3 0 7 3 0 0 0 1 2 3 1	3 24 0

Note

For the second group of data in the sample, let us assume the character set $\Sigma = \{'a','b','c'\}$. The 24 strings that meet the requirements are:

abbabbb	abbabbc	abcabcb	abcabcc	acbacbb	acbacbc
accaccb	accaccc	baabaaa	baabaac	bacbaca	bacbacc
bcabcaa	bcabcac	bccbcca	bccbccc	caacaaa	caacaab
cabcaba	cabcabb	cbacbaa	cbacbab	cbbcbba	cbbcbbb