

Hash Me Out

Assignment 5 Data Structures and Algorithms

Problem Statement: You have a container C, which is initially empty. You have to perform 3 types of operations :

1. Add number x to the container C
2. Delete number exactly one occurrence of x from the container C if it there in the container, otherwise do not do anything
3. Compute the hash of the container C

Hash function is defined as :

$$hash = \sum a * P^{rank(a)}$$

where sum iterates over all elements of the container and $rank(a)$ is defined as the number of elements from the container which are not greater than a .

You are given Q operations, where each operation is one of the above three.

Let you stored all the hashes you computed in an array H. You are asked to compute

$$V = \prod X^{H[i]}$$

where $H[i]$ is the i^{th} hash value you calculated

Input

First line of input contains three integers denoting the number of operations Q , the value P and the value X .

Q lines will be followed, each one containing one of the following three operations :

$A\ x$: Add element x to the container

$D\ x$: Delete element x from the container

H : Compute the hash of the container

Output

Output the value V . Since this value can be large, print its modulus $10^9 + 7$.

Constraints

$$1 \leq Q, P \leq 10^6$$

$$0 \leq x, X \leq 10^9$$

Time Limit: 4 seconds

Memory Limit: 256 MB

Sample Test Case

Input	Output
6 2 2 A 1 A 2 H A 3 D 2 H	16777216
11 2 2 A 3 A 2 A 3 A 2 H D 2 D 3 H D 2 A 1 H	495194301

Explanation

For first test case :

Third operation will compute hash as following:

$$1 * Prank^{(1)} + 2 * Prank^{(2)} = 1 * 2^1 + 2 * 2^2 = 10$$

Sixth operation will compute hash as following:

$$1 * Prank^{(1)} + 3 * Prank^{(3)} = 1 * 2^1 + 3 * 2^2 = 14$$

Answer is $2^{10} * 2^{14} = 16777216$