

# 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 :

$$hash = (\sum a * P^{rank(a)}) \% (10^9 + 7)$$

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

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

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

$$1 \leq X \leq 10^9$$

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