Cute Matrix - Large

Assignment 4
Data Structures and Algorithms

Problem Statement: Cute matrices are such matrices which obey :

- A Cute matrix can only be of dimensions $N * M$, where $N, M \geq 2$.
- The xor of the of 4 corner cell elements equals 0.
- A matrix is Cute only if it's all sub-matrices of dimensions $p * q$ $(2 \leq p \leq N, 2 \leq q \leq M)$ are all Cute.

Initially you have an empty matrix of dimensions $N * M$. You know that matrix can take in values only in the range $(0, 2^{30} - 1)$.
Now there are K queries .Query $-(i, j, p)-$ write p to cell (i, j) .After each such write , you have to find no. of ways of filling the matrix to make it cute .
You need not to output ways after each case .You have to output a hash value defined as $\Pi(x^{ans(i)})$ mod $1e9 + 7$ where $ans(i)$ is the no. of ways of filling the matrix after $i - th$ write for all i's from 1 to K . x is given in input .

Input
First line contains three integers N, M, K and x.
Next K lines contains description of queries.
$i - th$ of the next K lines contains 3 integers i, j, v. which means write the value v to cell (i, j).
Output
Print the hash value.
Constraints
$2 \leq N, M \leq 10^9$
$1 \leq K \leq min(10^6, N * M - 1)$
$1 \leq x \leq 10^8$
$0 \leq v < 2^{30}$
$1 \leq i \leq N$
$1 \leq j \leq M$

Time Limit: 4 seconds
Memory Limit: 256 MB

Sample Test Case

Input	Output
2 2 3 2 1 2 4 2 2 7 2 1 3	242602424

Input	Output
3 3 2 2 1 3 4 2 3 4	132526192

Input	Output
3 3 4 2 1 1 5 1 3 7 2 2 4 2 3 6	598815595

Explanation
In the first sample,
after 1st move number of ways : a = 2^{60}
after 2nd move number of ways : b = 2^{30}
after 3rd move number of ways : c = 1
So, hash = $2^{a+b+c} mod(1e9+7) = 242602424$