

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 $\Pi(x^{ans(i)}) \bmod 1e9 + 7$ 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

$$1 \leq N, M \leq 10^9$$

$$1 \leq K \leq \min(10^6, N * M - 1)$$

$$1 \leq x \leq 10^8$$

$$0 \leq v < 2^{30}$$

$$1 \leq i \leq N$$

$$1 \leq j \leq M$$

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