



CTU Open Contest 2026

Trains

`trains.(c|cpp|py), Trains.(java|kt)`

Míša is looking down at a railway station with m parallel straight tracks, each holding exactly one train. Each track is an infinite line of unit-length cells with its own integer coordinates. Míša can only see the cells numbered $0, 1, \dots, n-1$ of each track.

Each train is described by four values: the position p_i of its leftmost cell at time 0, its speed s_i , its direction $d_i \in \{L, R\}$, and its length in cells ℓ_i .

The train on track i occupies ℓ_i consecutive cells, which at time 0 are $p_i, p_i + 1, \dots, p_i + \ell_i - 1$. It moves as a single rigid block at constant speed s_i cells per unit of time, in direction $d_i \in \{L, R\}$ (R means increasing coordinates, L means decreasing coordinates). Thus, at time t the train occupies cells $p_i + v_i \cdot t, \dots, p_i + v_i \cdot t + \ell_i - 1$, where $v_i = s_i$ if $d_i = R$ and $v_i = -s_i$ if $d_i = L$.

The engine always occupies a cell at the front of the train: cell $p_i + v_i \cdot t + \ell_i - 1$ if $d_i = R$, or cell $p_i + v_i \cdot t$ if $d_i = L$. Every other cell of the train is a car.

Given the time t , determine what Míša sees: for each track and each visible cell $0, \dots, n-1$, indicate whether the cell is empty, holds the train engine or a train car.

Input Specification

The first input line contains three integers n, m, t ($1 \leq n, m \leq 10^5$, $n \cdot m \leq 4 \cdot 10^6$, $0 \leq t \leq 10^4$), the number of visible cells in each track, the number of tracks, and the current time.

Each of the next m lines describes a train on one track, using four values p_i, s_i, d_i, ℓ_i : the position of the train's leftmost cell at time 0 ($-10^5 \leq p_i \leq 10^5$), the train speed ($0 \leq s_i \leq 10^5$), the train direction ($d_i \in \{L, R\}$), and the train length in cells ($1 \leq \ell_i \leq 10^5$).

Output Specification

Output m lines, one per track in the same order as the input. Line i must contain exactly n printable characters, where the j -th character (for $j = 0, \dots, n-1$) describes cell j of track i at time t : `!` if the cell holds the engine, `#` if the cell holds a car, and `=` if the cell is empty.

Sample Input 1

```
10 3 3
0 1 R 1
9 1 L 1
7 0 R 2
```

Output for Sample Input 1

```
===!=====
=====!=
=====#!=
```

Sample Input 2

6 2 1
-2 1 R 5
4 0 L 5

Output for Sample Input 2

###!=
====!#

Sample Input 3

5 3 3
10 0 R 3
0 1 R 1
-5 2 R 1

Output for Sample Input 3

=====
===!=
=!===