APIO '18 P1 - New Home

Wu-Fu Street is an incredibly straight street that can be described as a one-dimensional number line, and each building's location on the street can be represented with just one number. Xiao-Ming the Time Traveler knows that there are n stores of k store-types that had opened, has opened, or will open on the street. The i-th store can be described with four integers: x_i, t_i, a_i, b_i, representing the store's location, the store's type, the year when it starts its business, and the year when it is closed.

Xiao-Ming the Time Traveler wants to choose a certain year and a certain location on Wu-Fu Street to live in. He has narrowed down his preference list to q location-year pairs. The i-th pair can be described with two integers: l_i, y_i, representing the location and the year of the pair. Now he wants to evaluate the life quality of these pairs. He defines the inconvenience index of a location-year pair to be the inaccessibility of the most inaccessible store-type of that pair. The inaccessibility of a location-year pair to store-type t is defined as the distance from the location to the nearest type-t store that is open in the year. We say the i-th store is open in the year y if $a_i \leq y \leq b_i$. Note that in some years, Wu-Fu Street may not have all the k store-types on it. In that case, the inconvenience index is defined as -1.

Your task is to help Xiao-Ming find out the inconvenience index of each location-year pair.

Input

The first line of input contains integer numbers n, k, and q: number of stores, number of types and number of queries ($1 \leq n, q \leq 3 \times 10^5$, $1 \leq k \leq n$). Next n lines contain descriptions of stores. Each description is four integers: x_i, t_i, a_i, and b_i ($1 \leq x_i, a_i, b_i \leq 10^8$, $1 \leq t_i \leq k$, $a_i \leq b_i$). Next q lines contain the queries. Each query is two integers: l_i, and y_i ($1 \leq l_i, y_i \leq 10^8$).

Output

Output q integers: for each query output its the inconvenience index.

Scoring

Subtask 1 (points: 5) $n, q \leq 400$

Subtask 2 (points: 7) $n, q \leq 6 \times 10^4$, $k \leq 400$

Subtask 3 (points: 10) $n, q \leq 3 \times 10^5$, $a_i = 1$, $b_i = 10^8$ for all stores.

Subtask 4 (points: 23) $n, q \leq 3 \times 10^5$, $a_i = 1$ for all stores.

Subtask 5 (points: 35) $n, q \leq 6 \times 10^4$

Subtask 6 (points: 20) $n, q \leq 3 \times 10^5$

Sample Input 1:

```
4 2 4
3 1 1 10
9 2 2 4
7 2 5 7
4 1 8 10
5 3
5 6
5 9
1 10
```

Sample Output 1:

```
4
2
-1
-1
```

Sample Input 2:

```
2 1 3
1 1 1 4
1 1 2 6
1 3
1 5
1 7
```

Sample Output 2:

```
0
0
-1
```

Sample Input 3:

```
1 1 1
100000000 1 1 1
1 1
```

Sample Output 3:

```
99999999
```

Explanation:

In the first example there are four stores, two types, and four queries.

- First query: Xiao-Ming lives in location 5 in year 3. In this year, stores 1 and 2 are open, distance to store 1 is 2, distance to store 2 is 4. Maximum is 4.
- Second query: Xiao-Ming lives in location 5 in year 6. In this year, stores 1 and 3 are open, distance to store 1 is 2, distance to store 3 is 2. Maximum is 2.
- Third query: Xiao-Ming lives in location 5 in year 9. In this year, stores 1 and 4 are open, they both have type 1, so there is no store of type 2, inconvenience index is -1. • Same situation in fourth query.

In the second example there are two stores, one type, and three queries. Both stores have location 1, and in all queries Xiao-Ming lives at location 1. In first two queries at least one of stores is open, so answer is 0, in third query both stores are closed, so answer is -1.

In the third example there is one store and one query. Distance between locations is 99999999.