Parkour

Time limit: *2500 ms*
Memory limit: *256 MB*

Catom is practicing parkour in the scaffolding of the new building in the city. The floor of the scaffolding is a grid. The cell in the x-th position to the right and the y-th position to the top has coordinates (x, y). Each cell should contain a floor tile. But as the building is not finished, there are only N cells numbered from 1 to N that currently contains a floor tile at positions $(x_1, y_1), (x_2, y_2), \ldots, (x_N, y_N)$. These tiles are glued to the floor and called *stable tiles*.

In the entrance of the building there are k floor tiles waiting to be put on the floor. These tiles are called *movable tiles*. The movable tiles are very heavy and can only be moved using a crane. Catom has a remote control for the crane but it is very complicated to operate. Catom can thus only use the crane to move a movable tile when he is on a stable tile, because he needs the balance. When a movable floor tile is placed on a cell, it does not become glued to it, so it may be moved again. In other words, Catom can replace the movable floor tiles wherever he likes when standing on a stable tile.

Parkour is the art of getting from one point to another in a complex environment. Catom starts at stable tile s and wishes to reach stable tile t under the following constraints:

- Catom can only step on floor tiles on his way.
- Catom can move from one floor tile to another only if they share a common edge.
- Catom can only move the movable tiles, and only when he is on a stable tile.

Help Catom complete his parkour training by determining for some (s, t, k) values whether or not Catom can go from stable tile s to stable tile t. You need to answer Q such queries $(s_1, t_1, k_1), (s_2, t_2, k_2), \ldots, (s_Q, t_Q, k_Q)$.

Standard input

To reduce the size of the input file, not all input data will be given explicitly. Instead, a set of parameters will be provided to generate the data.

The input has four integers N, Q, S_Q, M_k on the first line. S_Q is the number of queries that are explicitly given. M_k is a modulus used for generating the data.

The following N lines each have two integers as the position of one stable tile. The i-th line has x_i and y_i.

The next line has nine integer parameters $A_s, B_s, C_s, A_t, B_t, C_t, A_k, B_k, C_k$. These are followed by S_Q lines that each contain three integers as one query. The i-th line has s_i, t_i, k_i. The remaining queries with $S_Q < i \leq Q$ are generated using the following rules:

- $s_i = (A_s \cdot s_{i-1} + B_s \cdot s_{i-2} + C_s) \ mod \ N + 1$
- $t_i = (A_t \cdot t_{i-1} + B_t \cdot t_{i-2} + C_t) \ mod \ N + 1$
- $k_i = (A_k \cdot k_{i-1} + B_k \cdot k_{i-2} + C_k) \ mod \ M_k$

Standard output

Let the answer to the i-th query be R_i. If Catom can reach stable tile t from stable tile s then $R_i = 1$, and otherwise $R_i = 0$. Output a single integer $\sum_{1 \leq i \leq Q} R_i \cdot 2^i \ mod \ (10^9 + 7)$, which is the combined answers to all queries.

Constraints and notes

- $1 \leq N \leq 10^5$
- $1 \leq Q \leq 10^7$
- $2 \leq S_Q \leq Q$
- $1 \leq M_k \leq 10^9$
- $0 \leq x_i, y_i < 10^9$ for $1 \leq i \leq N$, all (x_i, y_i) are unique.
- $1 \leq s_i, t_i \leq N, 0 \leq k_i < M_k$ for $1 \leq i \leq Q$
- $0 \leq A_s, B_s, C_s, A_t, B_t, C_t, A_k, B_k, C_k \leq 10^9$

- For 25% of the test data, $N, Q \leq 500$.
- For another 25% of the test data, $N, Q \leq 10^5$ and $1 \leq M_k \leq 4$.
- For another 25% of the test data, $N, Q \leq 10^5$.

Input

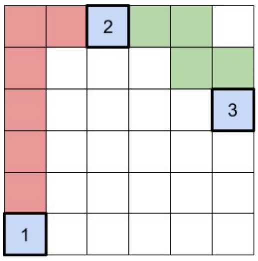
```
3 2 2 100
0 0
2 5
5 3
0 0 0 0 0 0 0 0 0
1 3 6
2 1 5
```

Output

```
2
```

Explanation

All stable tile positions and queries are explicitly given. The three stable tiles are illustrated below in blue.



For the query $s_1 = 1, t_1 = 3, k_1 = 6$ the answer should be $R_1 = 1$, because Catom can put the 6 movable floor tiles in a path from stable tile 1 to stable tile 2 (shown in red), go to stable tile 2, then move 4 of the movable tiles to connect stable tile 2 and stable tile 3 (shown in green) and finally get to stable tile 3.

For the query $s_2 = 2, t_2 = 1, k_2 = 5$ the answer should be $R_2 = 0$ since Catom can not reach stable tile 1 with fewer than 6 movable tiles.

The answer is therefore
$(R_1 \cdot 2^1 + R_2 \cdot 2^2) \ mod \ (10^9 + 7) = (1 \cdot 2 + 0 \cdot 4) \ mod \ (10^9 + 7) = 2$

Input

```
3 7 2 9
0 0
2 5
5 3
7 8 10 3 2 1 5 4 59
1 3 6
2 1 5
```

Output

```
242
```

Explanation

Just 2 queries are explicitly given. The three stable tiles are the same as in test case #1.

The 7 queries are

```
1 3 6
2 1 5
3 2 0
3 1 7
2 3 4
1 1 8
1 2 7
```

$R_1, R_4, R_5, R_6, R_7 = 1$

$R_2, R_3 = 0$

Input	Output	Explanation
		The answer is therefore $(R_1 \cdot 2^1 + R_2 \cdot 2^2 + \cdots + R_7 \cdot 2^7)\ mod\ (10^9 + 7)$ $= (1 \cdot 2 + 0 \cdot 4 + 0 \cdot 8 + 1 \cdot 16 + 1 \cdot 32 + 1 \cdot 64 + 1 \cdot 128)\ mod\ (10^9 + 7)$ $= 242$