Parkour

Time limit: *6250 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

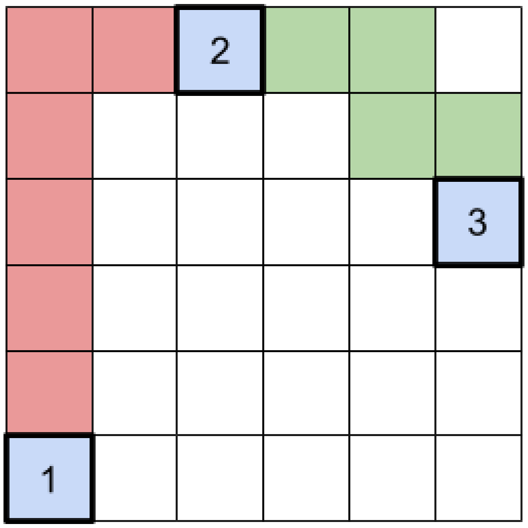
Let the answer to the i-th query be R_i. If Catom can reach stable tile t from stable tile s then $R_i=1$, and otherwise $R_i=0$. Output a single integer $\sum_{1\leq i \leq Q} R_i \cdot 2^i ~mod~ (10^9 + 7)$, which is the combined answers to all queries.

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	Output	Explanation
3 2 2 100 0 0 2 5 5 3 0 0 0 0 0 0 0 0 0 1 3 6	2	All stable tile positions and queries are explicitly given. The three stable tiles are illustrated below in blue.

<table>
<tr><th>Input</th><th>Output</th><th>Explanation</th></tr>
<tr><td>2 1 5</td><td></td><td>


For the query s_1=1, t_1=3, k_1=6$s_1=1, t_1=3, k_1=6$ the answer should be R_1=1$R_1=1$, because Catom can put the 66 movable floor tiles in a path from stable tile 11 to stable tile 22 (shown in red), go to stable tile 22, then move 44 of the movable tiles to connect stable tile 22 and stable tile 33 (shown in green) and finally get to stable tile 33.

For the query s_2=2, t_2=1, k_2=5$s_2=2, t_2=1, k_2=5$ the answer should be R_2=0$R_2=0$ since Catom can not reach stable tile 11 with fewer than 66 movable tiles.

The answer is therefore (R_1 \cdot 2^1 + R_2 \cdot 2^2)~mod~ (10^9 + 7) = (1 \cdot 2 + 0 \cdot4) ~mod~ (10^9 + 7) = 2$(R_1 \cdot 2^1 + R_2 \cdot 2^2)\ mod\ (10^9 + 7) = (1 \cdot 2 + 0 \cdot 4)\ mod\ (10^9 + 7) = 2$
</td></tr>
<tr><td>3 7 2
9

0 0

2 5

5 3

7 8 1
0 3 2
1 5 4
59

1 3 6</td><td>242</td><td>
Just 22 queries are explicitly given. The three stable tiles are the same as in test case #1.

The 77 queries are

```
1 3 6
2 1 5
3 2 0
3 1 7
2 3 4
1 1 8
1 2 7
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R_1, R_4, R_5, R_6, R_7 = 1$R_1, R_4, R_5, R_6, R_7 = 1$
</td></tr>
</table>

Input	Output	Explanation
`2 1 5`		R_2, R_3 = 0$R_2, R_3=0$ The answer is therefore (R_1 \cdot 2^1 + R_2 \cdot 2^2 + \cdots + R_7 \cdot 2^7)~mod~ (10^9 + 7)$(R_1 \cdot 2_1 + R_2 \cdot 2_2 + \cdots + R_7 \cdot 2_7)$ *mod* (10_9+7) = (1 \cdot 2 + 0 \cdot4 + 0 \cdot8 + 1 \cdot 16 + 1 \cdot 32 + 1 \cdot 64+ 1 \cdot 128) ~mod~ (10^9 + 7)$=(1\cdot2+0\cdot4+0\cdot8+1\cdot16+1\cdot32+1\cdot64+1\cdot128)$ *mod* (10_9+7) = 242$=242$