

Kitchen

Input file: **standard input**
Output file: **standard output**
Time limit: 2 seconds
Memory limit: 1024 mebibytes

Upon entering his kitchen, Petya discovered a terrible surprise: it was infested with cockroaches!

Without wasting a moment, he placed poisonous baits in several spots to exterminate them. Since he did this in a hurry, there was a chance that some cockroaches would survive. Help him predict the outcome.

By the rectangular shape of their bodies, Petya was able to determine that the cockroaches belonged to a rare species of Manhattan cockroaches. If such a cockroach runs from point (x_1, y_1) to point (x_2, y_2) , it first runs in a straight line to point (x_2, y_1) , and then it runs from there in a straight line to (x_2, y_2) .

Each cockroach chooses the bait that minimizes its travel time (and if there are multiple such baits, it chooses the one with the lexicographically smallest coordinates (x_j, y_j)) and moves towards it at a speed of 1 meter per second. When a cockroach reaches the bait, it instantly eats it completely, after which all cockroaches that were running towards it change their target according to the algorithm described above. If several cockroaches reach the same bait simultaneously, the one whose original coordinates were given in the input data first eats it in the heat of intra-species competition.

Since these cockroaches are extraordinarily resilient, they can survive if they eat fewer than a pieces of poison, and even after eating that amount or more, they remain active for t seconds before dying. If a cockroach reaches the bait exactly at the moment of its death, it still has time to eat it.

Input

The first line contains four integers n, m, a, t ($1 \leq n \leq 100, 1 \leq m \leq 1000, 1 \leq a \leq 1000, 0 \leq t \leq 10^9$), meaning that there are n cockroaches and m baits; after eating a baits, a cockroach will die in t seconds.

The second line contains two integers W and H ($1 \leq W, H \leq 10^9$): the dimensions of Petya's rectangular kitchen in meters.

Each of the following n lines contains two integers x, y ($0 \leq x \leq W, 0 \leq y \leq H$): the initial coordinates of another cockroach.

Each of the following m lines contains two integers x, y ($0 \leq x \leq W, 0 \leq y \leq H$): the coordinates of another bait. It is guaranteed that no two baits are located at the same point.

Output

For each cockroach, output a single integer in a separate line: the number of seconds after which it will die from the poison, or -1 if the cockroach survives. The answers for the cockroaches should be given in the same order as the coordinates of the cockroaches appear in the input data.

Example

standard input	standard output
3 3 1 2	-1
4 4	9
0 0	4
0 1	
1 1	
2 2	
3 3	
4 4	

Note

The coordinates (x_1, y_1) are *lexicographically smaller* than the coordinates (x_2, y_2) if either $x_1 < x_2$, or both $x_1 = x_2$ and $y_1 < y_2$.