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F - Connecting Points

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Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 500 points

Problem Statement

There is a graph G with N vertices and 0 edges on a 2-dimensional plane. The vertices are numbered from 1 to N , and vertex i is located at coordinates (x_i, y_i) .

For vertices u and v of G , the distance $d(u, v)$ between u and v is defined as the Manhattan distance $d(u, v) = |x_u - x_v| + |y_u - y_v|$.

Also, for two connected components A and B of G , let $V(A)$ and $V(B)$ be the vertex sets of A and B , respectively. The distance $d(A, B)$ between A and B is defined as $d(A, B) = \min\{d(u, v) \mid u \in V(A), v \in V(B)\}$.

Process Q queries as described below. Each query is one of the following three types:

- 1 a b : Let n be the number of vertices in G . Add vertex $n + 1$ to G with coordinates $(x_{n+1}, y_{n+1}) = (a, b)$.
- 2 : Let n be the number of vertices in G and m be the number of connected components.

- If $m = 1$, output -1.

- If $m \geq 2$, merge all connected components with the minimum distance and output the value of that minimum distance. Formally, let the connected components of G be A_1, A_2, \dots, A_m and let $k = \min_{1 \leq i < j \leq m} d(A_i, A_j)$. For all

pairs of vertices (u, v) ($1 \leq u < v \leq n$) that are not in the same connected

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component and satisfy $d(u, v) = k$, add an edge between vertices u and v .

Then, output k .

- 3 $u\ v$: If vertices u and v are in the same connected component, output Yes; otherwise, output No.

Constraints

- $2 \leq N \leq 1500$
- $1 \leq Q \leq 1500$
- $0 \leq x_i, y_i \leq 10^9$
- For queries of type 1, $0 \leq a, b \leq 10^9$.
- For queries of type 3, let n be the number of vertices in G just before processing that query, then $1 \leq u < v \leq n$.
- All input values are integers.

Input

The input is given from Standard Input in the following format, where query_i is the i -th query to be processed.

```
 $N\ Q$   
 $x_1\ y_1$   
 $x_2\ y_2$   
 $\vdots$   
 $x_N\ y_N$   
 $\text{query}_1$   
 $\text{query}_2$   
 $\vdots$   
 $\text{query}_Q$ 
```

Each query is given in one of the following three formats:

```
1  $a\ b$ 
```

```
2
```

```
3  $u\ v$ 
```

Output

Output the answers to the queries separated by newlines, following the instructions in the problem statement.

Sample Input 1

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```
4 11
3 4
3 3
7 3
2 2
3 1 2
2
3 1 2
1 6 4
2
3 2 5
2
3 2 5
2
1 2 2
2
```

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Sample Output 1

Copy

```
No
1
Yes
2
No
3
Yes
-1
0
```

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Initially, vertices 1, 2, 3, 4 are located at coordinates (3, 4), (3, 3), (7, 3), (2, 2), respectively.

- For the 1st query, vertices 1 and 2 are not connected, so output No.
- For the 2nd query, there are 4 connected components, and the vertex set of each connected component is {1}, {2}, {3}, {4}. The minimum distance between different connected components is 1, and an edge is added between vertices 1 and 2. Output 1.
- For the 3rd query, vertices 1 and 2 are connected, so output Yes.
- For the 4th query, add vertex 5 at coordinates (6, 4).
- For the 5th query, there are 4 connected components, and the vertex set of each connected component is {1, 2}, {3}, {4}, {5}. The minimum distance between

different connected components is 2, and edges are added between vertices 2 and 4 and between vertices 3 and 5. Output 2.

- For the 6th query, vertices 2 and 5 are not connected, so output No.
- For the 7th query, there are 2 connected components, and the vertex set of each connected component is $\{1, 2, 4\}$, $\{3, 5\}$. The minimum distance between different connected components is 3, and an edge is added between vertices 1 and 5. Output 3.
- For the 8th query, vertices 2 and 5 are connected, so output Yes.
- For the 9th query, there is 1 connected component, so output — 1.
- For the 10th query, add vertex 6 at coordinates (2, 2).
- For the 11th query, there are 2 connected components, and the vertex set of each connected component is $\{1, 2, 3, 4, 5\}$, $\{6\}$. The minimum distance between different connected components is 0, and an edge is added between vertices 4 and 6. Output 0.

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