Phones Assignment

(Deadline: 2nd of June 2022, Thursday, 23:59)

1 Problem

Ayşe studies electromagnetic waves and have recently conducted an experiment for her new cell phone localization algorithm. As the output of her experiment (and as a remarkable achievement), she obtained the locations of all of the cell phones being operated in the city, as a two-dimensional map.

Unfortunately, Ayşe is certain that her algorithm has a bug. When she looked at her two-dimensional map, she noticed that some cell phones seem to be located outside all of the buildings. Apparently, these phones are some false positives that are incorrectly detected due to the algorithm's bug. Your job is to help Ayşe understand the scale of the bug, by counting the number of false positives.

Ayşe's map uses a $x - y$ coordinate system whose bottom-left corner is (0,0). There are $\texttt{N}$ buildings in the map and each building is in the the form of an axis-aligned rectangle whose base sits on the $y = 0$ line. In other words, one can define each building as a triple ($\texttt{L}_i$, $\texttt{H}_i$, $\texttt{R}_i$), where

- $\texttt{L}_i$ is the x-coordinate of the left edge of the building.
- $\texttt{H}_i$ is the height of the building, i.e., the y-coordinate of the top edge of the building.
- $\texttt{R}_i$ is the x-coordinate of the right edge of the building.

Each of the $\texttt{M}$ phones occupies a single point ($\texttt{X}_i$, $\texttt{Y}_i$) in the map. A phone is considered to be inside a building if it coincides with the building's interior or its boundary. A phone is a false positive if it is not inside any buildings.

2 Input Format

```
N
L_1  H_1  R_1
L_2  H_2  R_2
...
L_N  H_N  R_N
M
X_1  Y_1
X_2  Y_2
...
X_M  Y_M
```

$\texttt{N}$ = The number of buildings in the map.
$\texttt{L}_i$ = The x-coordinate of the left edge of the ith building.
$\texttt{H}_i$ = The y-coordinate of the top edge of the ith building.
$\texttt{R}_i$ = The x-coordinate of the right edge of the ith building.
$\texttt{M}$ = The number of phines in the map.
$\texttt{X}_i$ = The x-coordinate of the ith phone.
$\texttt{Y}_i$ = The y-coordinate of the ith phone.

3 Output Format

```
F
```

$\texttt{F}$ = The number of false positives, i.e., the number of phones outside any buildings.

4 Limits

$1 \leq N, M \leq 100000$
$0 \leq L_i, H_i, M_i, X_i, Y_i \leq 10^9$
All coordinates are integers.
Time Limit: 1 second
Memory Limit: 256 MB

5 Clarifications

- A solution with $O((N+M)\log(N+M))$ time is expected to get full points in this assignment. However, you can get partial points for a slower solution. If you are unable to code the expected solution, please code a slower one.
- Your solution is expected as a C++ program source named `phones.cpp` that reads from the standard input and writes to the standard output.
- It is OK to copy code from the sample codes we shared in our course website in ODTÜClass for this assignment.
- You are supposed to submit your code via ODTÜClass, via an auto-grader that we will prepare in the next few days.
- The grade from the auto-grader is not final. We can later do further evaluations of your code and adjust your grade. Solutions that do not attempt a "reasonable solution" to the given task may lose points.
- We will compile your code on g++ with options: `-std=c++17 -O2 -lm -Wall -Wextra -Wpedantic`
- Late submissions are not allowed.

6 Example

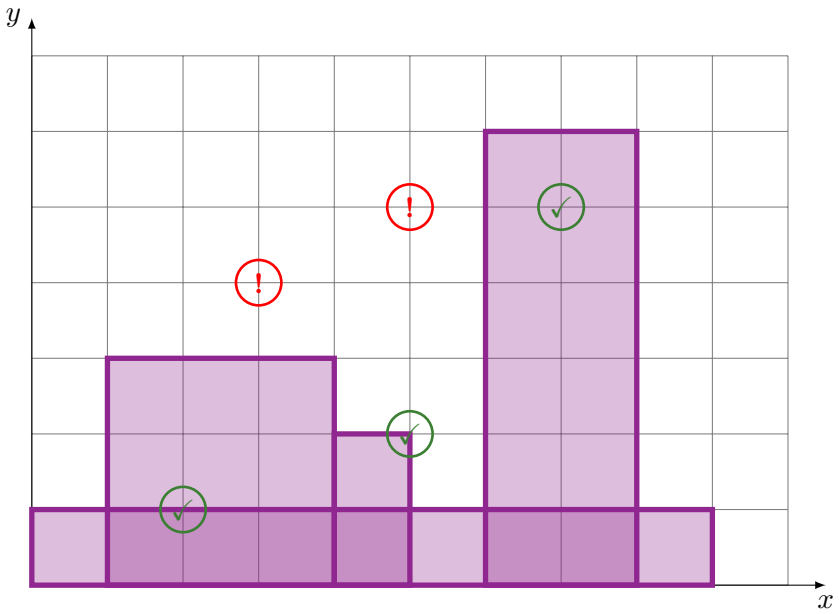
Sample Input

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

Sample Output

```
2
```

See below for graphical explanation.


y
x