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Exercise – *Lestrade*

Professor Moriarty strikes again. In exactly 24 hours one of his gang members will try to assault a prominent member of London's high society. We do not know *where* the assault will take place, or by *whom* and *how* it will be performed. These three questions must be answered in time!

Inspector Lestrade has two options: Either he orders all his agents to spy on the members of Moriarty's gang or he hires Sherlock Holmes to solve the case. Holmes will solve the case for sure. However, he does not only request a huge fee, but his involvement undermines the inspector's authority. Therefore, Lestrade calls on Holmes only as a last resort or to save money.

Each of the a agents of Scotland Yard can spy on one gang member only, the one that is *closest* to the agent's location. You may assume that there is a unique closest gang member for each agent. Every agent i is described by a single integer z_i which specifies his hourly wage. If an agent works h_i hours, for arbitrary real value $0 \leq h_i \leq 24$, he gets paid $h_i \cdot z_i$ British pounds.

Each of the g members of Moriarty's gang is described by a triple $\ell_j = (u_j, v_j, w_j)$ that specifies how much information *per hour* this gang member leaks on the questions *where*, *who* and *how*, if he is spied on by at least one working agent. If there are $0 \leq h'_j \leq 24$ hours for which gang member j is being observed by at least one agent, then $h'_j \cdot \ell_j$ amount of information can be gathered from him.

Input The first line of the input contains the number $t \leq 100$ of test cases. Each of the t test cases is described as follows.

- It starts with a line that contains four integers `z u v w`, separated by a space and such that $0 \leq z, u, v, w \leq 2^{24}$. Here z denotes the fee requested by Sherlock Holmes (in British pounds), and the triple (u, v, w) denotes how much information on the questions *where, who, how* must at least be gathered by all the agents together to solve the case.
- The following line contains two integers `a g`, separated by a space and such that $1 \leq a \leq 4'000$ and $1 \leq g \leq 9 \cdot 10^4$. Here a denotes the number of agents and g denotes the number of gang members.
- The following g lines define the gang members. Each line contains five integers `x y u v w`, separated by a space and such that $|x|, |y| < 2^{24}$ and $0 \leq u, v, w \leq 2^{10}$. In this way, the j-th gang member, for $j \in \{0, \ldots, g-1\}$, is defined by a 5-tuple $(x_j, y_j, u_j, v_j, w_j)$, where (x_j, y_j) describes her position and $\ell_j = (u_j, v_j, w_j)$ describes the information she leaks per hour.
- The final a lines define the agents. Each line contains three integers `x y z`, separated by a space and such that $|x|, |y| < 2^{24}$ and $1 \leq z \leq 2^{10}$. In this way, the i-th agent, for $i \in \{0, \ldots, a-1\}$, is defined by a 3-tuple (x_i, y_i, z_i), where (x_i, y_i) describes her position and z_i describes her hourly wage.

Output For each test case output a line with one single character: "L" or "H". The character is "L" if inspector Lestrade's agents can solve the case in time while being paid in total at most the Holmes' fee, or "H" for Holmes otherwise. The agents can solve the case if $\sum_{j=0}^{g-1} h'_j \cdot u_j \geq u$, $\sum_{j=0}^{g-1} h'_j \cdot v_j \geq v$, and $\sum_{j=0}^{g-1} h'_j \cdot w_j \geq w$ where h'_j denotes the number of hours gang member j is being observed by the agents.

Points There are four groups of test sets, worth 100 points in total.

1. For the first group of test sets, worth 30 points, you may assume that $g \leq 4'000$ and each gang member leaks the same amount of information on every subject, that is $u_j = v_j = w_j$, for all $j \in \{0, \ldots, g-1\}$.
2. For the second group of test sets, worth 20 points, you may assume that $g \leq 4'000$.
3. For the third group of test sets, worth 30 points, there are no additional assumptions.
4. For the fourth group of test sets, which is hidden and worth 20 points, you may assume that $g \leq 4'000$.

Corresponding sample test sets are contained in `test`i`.in/out`, for $i \in \{1, 2, 3\}$.

Sample Input

```
3
26 24 24 24
1 1
0 0 1 1 1
2 0 1
26 24 24 25
2 1
0 0 1 1 1
-1 0 2
2 0 1
26 24 24 24
1 2
0 0 1 1 1
3 0 1 1 0
2 0 1
```

Sample Output

```
L
H
H
```