Problem 232: Suit Up for Space

Difficulty: Medium

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Problem Background

NASA has its sights on bringing astronauts back to the Moon with the Artemis missions, and eventually onward to Mars. However, one of the greatest dangers that astronauts have to contend with in space is radiation. The Earth's atmosphere, magnetic field, and other effects protect us from large amounts of radiation constantly emitted by our sun and other sources throughout the universe. Away from these protections, however, this background cosmic radiation can quickly reach dangerous levels, presenting a major health hazard for anyone venturing into the stars.

Problem Description

United Launch Alliance, a joint venture between Lockheed Martin and Boeing, is working on developing new radiation shielding to be included in the walls of spacecraft and within astronaut's spacesuits to protect astronauts on future Mars missions. Researchers need to run some simulations to determine the level of protection offered by a variety of materials.

Each material being tested is capable of blocking a certain amount of radiation based on the thickness of the material; thicker materials can block more radiation and will therefore increase the amount of time an astronaut would be protected by that shield. Unfortunately, thicker materials also weigh and cost more, both important considerations when building a spacecraft.

Each test case will provide you with a list of materials that can be used to construct a radiation shield, and the absorption rate of that material (in millisieverts per mm of thickness). You'll then be provided with a list of scenarios the research team would like to consider. The team wants to know how long it would take for an astronaut protected by the described shield in the described environment to reach the maximum safe radiation dose of 50 millisieverts.

Sample Input

The first line of your program's input, received from the standard input channel, will contain a positive integer representing the number of test cases. Each test case will include:

- A line containing two positive integers, separated by spaces, representing:
  - M, the number of materials being tested, and
  - S, the number of scenarios in which to test those materials.
- M lines, each containing the following information separated by spaces:
  - The name of a shield material, which will contain upper and/or lower-case letters, and

    - A positive decimal, indicating the amount of radiation (in millisieverts) the material can offset per millimeter of thickness
- S lines, each containing the following information separated by spaces:
    - The name of a material being tested, which will match one of the material names previously given,
    - A positive decimal, indicating the thickness of the material in millimeters, and
    - A positive decimal, indicating the astronaut's unshielded absorption rate of background radiation in millisieverts per second

```
1
2 5
Lead 2
Steel 1.1
Lead 2 5
Lead 4 7.5
Steel 1 5.0
Steel 1.5 12.5
Steel 2.5 3.14
```

Sample Output

For each test case, your program must print a single line for each scenario presented in the test case, containing a decimal number (rounded to two decimal places and including any trailing zeroes) indicating the number of seconds at which an astronaut would receive the maximum safe radiation dose when protected by the indicated shield. In the event the shield is able to block all of the background radiation, instead print a line that contains the word "Infinity".

```
50.00
Infinity
12.82
4.61
128.21
```