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HS 2014
Exercise Sheet CGAL Week III

Algorithms Lab

Exercise 4 – *Inball*

The many-dimensional country of Ballland experienced a natural disaster and all its inhibitants have to seek shelter in its sophisticated system of underground caves. Unfortunatelly, some of the inhabitants of the Ballland have grown quite large (they are ball-shaped, indeed), it is necessary to figure out, how large inhabitants cave can still be accomodated in each cave. Each cave C is of a polyhedral shape, i.e., is described by n linear inequalities

$$C = \{\mathbf{x} \in \mathbb{R}^d \mid \mathbf{a}_i^T \mathbf{x} \leq b_i \,, i = 1, \ldots, n\},$$

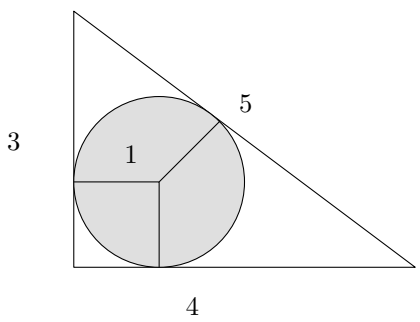
where $\mathbf{a}_i \in \mathbb{R}^d, b_i \in \mathbb{R}$. Here $\mathbf{a}_i^T \mathbf{x}$ denotes the standard scalar product of $\mathbf{a}_i$ and $\mathbf{x}$, i.e., $\mathbf{a}_i^T \mathbf{x} := \sum_{i=1}^{d} (\mathbf{a}_i)_j \mathbf{x}_j$.

Input The input contains several test cases. Each test case describes one cave. It begins with a line containing two integers n and d ($1 \leq d \leq 10$, $1 \leq n \leq 10^3$) where n is the number of inequalities describing the cave and d is its dimension.

Each subsequent line describes one inequality $\mathbf{a}_i^T \mathbf{x} \leq b_i$ and consist of $d+1$ space separated integers $(\mathbf{a}_i)_1 (\mathbf{a}_i)_2 \ldots (\mathbf{a}_i)_d b_i$ ($-2^{10} \leq (\mathbf{a}_i)_1, \ldots, (\mathbf{a}_i)_d, b_i \leq 2^{10}$). It is guaranteed, that the norm $\|\mathbf{a}_i\|_2 = \sqrt{\sum_{j=1}^{d} ((\mathbf{a}_i)_j)^2}$ of each $\mathbf{a}_i$ is an integer.

The input is terminated by a line containing a single value 0.

Output For each input, the output appears on a single and separate line. This line consists of a single integer r denoting the maximum integral radius of a d-dimensional ball, which fits into the cave. If the cave is an empty set, the word `none` is to be printed. If an arbitrarily large ball can be fit into the cave, the word `inf` should be printed.



Sample Input

```
3 2
-1 0 0
0 -1 0
3 4 12
2 1
1 0
-1 0
2 1
1 -1
-1 -1
0
```

Sample Output

```
1
0
none
```