13^{th} South African Regional
ACM Collegiate Programming Contest

Sponsored by IBM

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Problem A - Orange Balloon
Lightning

Problem Description

You are in a dispute with your insurance company regarding the cause of a fire that destroyed your crops. This is the second year in a row that you are claiming that lightning was the cause of the fire in a particular field; your insurance is now maintaining that lightning never strikes twice in the same spot.

Not easily deterred, you have now instrumented your farm with an array of microphones and light sensors. This will allow you to pinpoint the location of any lightning strike within the area that you are monitoring. The principle is simple: each microphone is connected to a light sensor. A lightning strike will trigger the light sensor, which in turn starts a timer running — this effectively synchronises all your sensors. The microphone output is then monitored for the characteristic signature of a thunder "clap", at which point the elapsed time is recorded. This allows you to measure the distance to the site of the lightning strike. With at least three such measurements, it becomes possible to triangulate the position of the strike relative to the coordinate frame of the array of microphones. Unfortunately, you know that there are some glitches in the system, and occasionally one of your sensors will trigger too soon or too late, effectively producing an error in the distance estimate at that sensor.

Your task is to write the software that, given the location of the microphones and the time delay before the sound reached each microphone, must compute the location of the lightning strike, while allowing for at most one erroneous sensor reading.

Input

Your input consists of an arbitrary number of records, each record conforming to the following format:

n
$x_1 \quad y_1 \quad x_2 \quad y_2 \quad \ldots \quad x_n \quad y_n$
$t_1 \quad t_2 \quad \ldots \quad t_n$

where n denotes the number of microphones. The value n is followed by n pairs of x- and y-coordinates in metres. Lastly, the record contains n timing values (measured in seconds), corresponding to the elapsed time between the lightning strike and the sound arriving at the microphone. You may assume that the speed of sound is 330 ms^{-1}.

The number n is in the range 4..10, and the microphone coordinates are in the range $x \in [0, 10000]$, $y \in [0, 10000]$, with lightning strikes occurring in the same range as the microphone coordinates. You may assume that the distribution of the microphones is such that triangulation is possible for the given input values.

The end of input is indicated by a line containing only the value -1, equivalent to $n == -1$.

Output

For each input record, print out the line

`lightning strike at coordinates (x,y)`

where `x` and `y` denotes the coordinates in metres, relative to (0,0), at which the lightning strike occurred. Please note that lightning strike coordinates must be rounded to the nearest multiple of 10 metres.

Sample Input

```
5
0 0 1000 0 0 1000 3000 1000 10 3000
2.142748 2.142748 2.142748 7.725787 8.073195
5
0 0 1000 0 0 1000 3000 1000 10 3000
9.870605 7.048305 9.393939 0.303030 11.232874
-1
```

Sample Output

```
lightning strike at coordinates (500,500)
lightning strike at coordinates (3100,1000)
```

Time Limit

10 seconds