

OVERVIEW

INFORMATION

(A) GETTING STARTED

(B) TF-IDF

(C) BIG BANG

(D) CHECKMATE

CUSTOM TEST

QUESTIONS

ANNOUNCEMENTS (5)

Code	Meaning
WA	Wrong answer
OK	Correct answer
MLE	Memory limit exceeded
TLE	Time limit exceeded
RTE	Runtime error
NT	Testing skipped
CE	Compilation error
?	Result unavailable
-	Testing pending

Big Bang

time limit	memory limit	input	output
10 s	64 MB	standard input	standard output

Big bang

Description:

At the **beginning of time** (K seconds ago), N particles were scattered around the origin point by normal distribution around every axis. You're given positions of these particles after they were moving for K (whole) seconds.

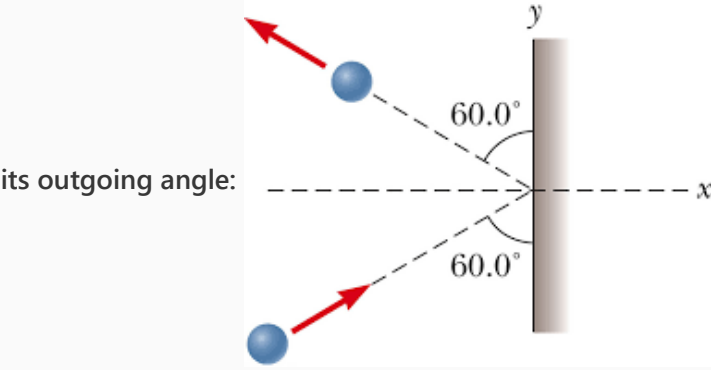
- Particles are in a two-dimensional space
- Each particle has position and velocity described by two coordinates - P_x , P_y and V_x , V_y respectively.
- V_x and V_y represent the velocity vector and describe how many units per second the particle moves in the x and y direction
- Particles move one velocity vector per second.
- Particles do not lose momentum or velocity and they do not collide with each other.

Given these particles, you need to answer the following questions:

A) How many seconds ago (K , integer) was the **beginning of time**, given the particles at input as the **final** position? Assume that all particles were moving in a straight line along their velocity vectors since the beginning of time and nothing had changed their direction.

B) All particles exist in an $2S \times 2S$ unit square which has center at origin (0,0). In other words particles are bound by $[-S, S]$ around each axis. Particles cannot exit the square, but when they hit the square they reflect off its inner sides without any momentum loss. Given the particles at input as the **starting** position, how many times have all particles hit the sides of the square in the following T seconds?

Particles reflect off the wall such that the incoming angle of the particle with the wall is the same as



C) Each time a particle reflects off the square, it has a probability P of *NOT* being absorbed by the square. What is the expected number of remaining particles after T seconds?

Input format:

All inputs will be given through the standard input. The first line of input consists of 4 numbers: N S T P .

N (integer) represents the number of particles. S (integer) is the half-length of square sides, while center of the square is at origin (0,0). T (integer) stands for the time in seconds during which particles reflect off the square. Finally, P (float) is the probability of the particle reflecting and not being absorbed by the square.

The following N lines of the input represent the particles in format: P_x P_y V_x V_y . Where P_x (float) and P_y (float) stand for position of the particle. V_x (float) and V_y (float) represent the velocity vector of the particle.

Output format:

Output answers to subtasks as 3 numbers T_a , T_b , T_c . The expected output format is to have 3 numbers in one line of output. If you calculate the solution to only one or two subtasks, return -1 as a result for other subtasks. For example, if you calculate only the result of subtask 2 you would return -1 T_b -1 .

- T_a (integer) is answer to the **A)** subtask - how many seconds ago was the beginning of time.
- T_b (integer) is the answer to the **B)** subtask - how many times have particles hit the square sides.
- T_c (float) is the answer to the **C)** subtask - what is the expected number of remaining particles.

Example:

Input:
2 10 2 0.5
9.1 2.9 3.0 1.0
-6.1 -6.2 -2.0 -2.0

Output:
3 3 0.75

- Explanation:
- The particles are closest to the center $\{P1: (0.1, -0.1), P2: (-0.1, -0.2)\}$ 3 seconds before their initial position.
 - 2 Seconds after the initial position the first particle hit the wall once (on the x axis in the first second) and the second particle hit the wall twice (on x axis and the y axis in the second second). Thus, the total number of hits is 3.
 - Considering that the first particle has hit the wall once and the second particle has hit the world twice, the expected number of remaining particles is 0.75.

Scoring

- Correct result for task 1 brings 40 points per test case.
- Correct result for task 2 brings 30 points per test case.
- Correct result for task 3 brings 30 points per test case.
- Probabilities in task 3 are considered correct if they don't differ from the expected values by more than 0.05

Datasets

There are two data sets:

- *Public data set* is used for developing your solution. After you submit your solution, you will be able to see how well your solution performs against this data set. *Public data set* is not used for calculating the final score. Public data set is available **here**.
- *Private data set* is used for testing your solution. The final score will be measured against this data set. *Private data set* and the final score will be available after the homework finishes. *Private data set* contains different data than the *public data set*, but the type of data is roughly the same (the same constraints apply).

LOADSEND

Select programming language

Python 3.x

1



