In a world without gravity, a very small gun shooting point-like balls is located at the lower left end $(0, 0)$ of a 2D corridor. The corridor has length $L = 100$ m and height $h = 5$ m. The gun shoots with initial velocity $v = 1$ m/s at a random angle α, distributed uniformly between 0 and $\pi/4$. Each time the ball bounces off the wall, its velocity component *perpendicular to the wall* is reduced by a fraction $\eta/(1 + \eta)$,

$$v_{\text{vertical}} \quad \longrightarrow \quad -\left(1 - \frac{\eta}{1+\eta}\right) v_{\text{vertical}} \ ,$$

where η has an exponential distribution with mean $\bar{\eta} = 0.15$ and is drawn independently for every bounce.

Write a working Java program (very good C/C++ code is also acceptable, but we strongly prefer Java) which calculates the following results:

1. the average time $\bar{T}$ it takes the ball to reach the end of the corridor,
2. the average number $\bar{N}$ of the times the ball will bounce off the walls before exiting the corridor,
3. (for bonus points) Monte Carlo errors of both quantities

You can use a random number generator returning random numbers uniformly between 0 and 1. Remember that you will be marked on both the accuracy of results and your programming style.

Can you think of any analytical approximations which you could use to test the results of your program? Would the problem become simpler if $\eta = 0$?