FACULTY OF MATHEMATICS AND PHYSICS

# Random walk in 2D square grid

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December 8, 2022

## 1 SIMPLE WALK

This is a walk, where all direction are equally likely at each point of the walk. We have simulated $N = 1600$ for a length of the walk $n = 2^x$, where $x \in \{2,\ 3, \ldots,\ 16,\ 17\}$. For $N = 1600$ we have standard deviation $\sigma \sim \frac{1}{\sqrt{N}} = 0.025$ for each simulated value. We have fitted results of the simulation in the form:

$$\ln[R(n)] = \ln(c) + \alpha \ln(n),$$

where $R(n)$ is an Euclidean distance between the origin and the final position of the walk, $n$ is a length of the walk, and $c$ and $\alpha$ are fitting parameters. The dependence came out linear as expected, see 1.1, fitted parameters are:

$$\alpha = 0.507 \pm 0.004, \tag{1.1}$$
$$c = 0.884 \pm 0.025 \tag{1.2}$$

## 2 NON-RETURNING WALK

For this walk, we have repeated the same procedure as in simple walk.

$$\alpha = 0.530 \pm 0.004, \tag{2.1}$$
$$c = 1.012 \pm 0.029 \tag{2.2}$$

## 3 NON-CROSSING WALK

We simulated $N = 40000$ random walks with the length set to $n = 10000$, but all walks were terminated at most after 600 steps. Here is an example of one of the longest walks 3.1. The average length of this walk altered between $70 - 71$ as expected.

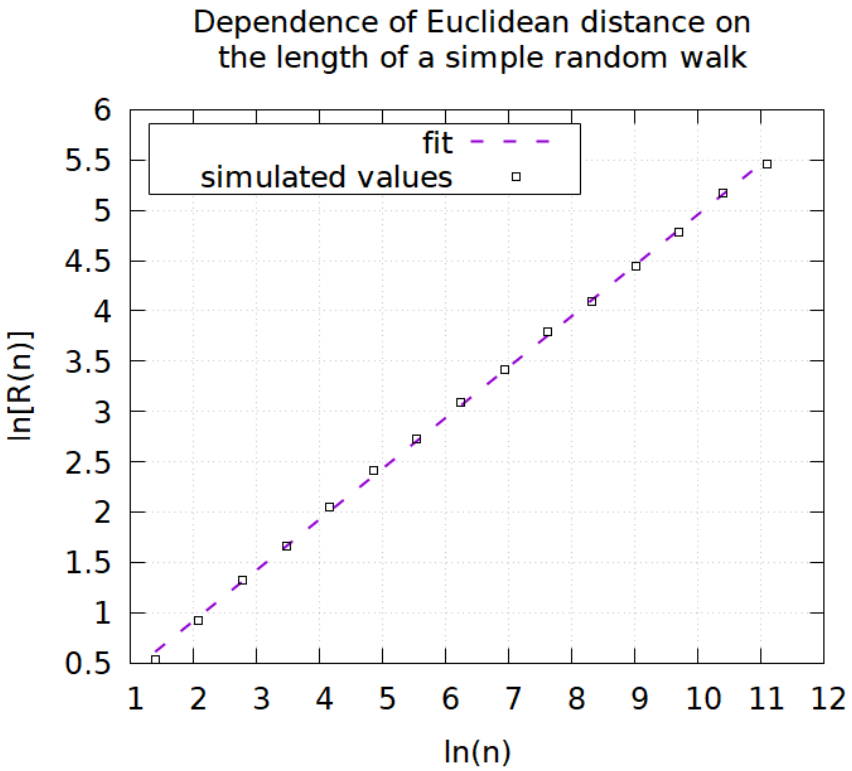


Figure 1.1: Euclidean distance for simple walk.

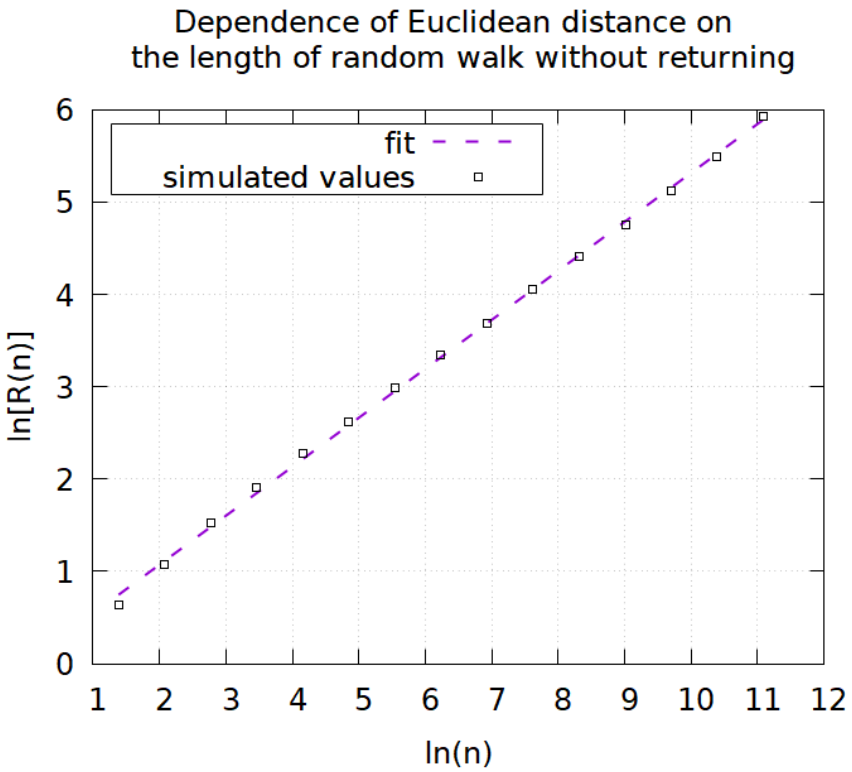


Figure 2.1: Euclidean distance for non-returning walk.

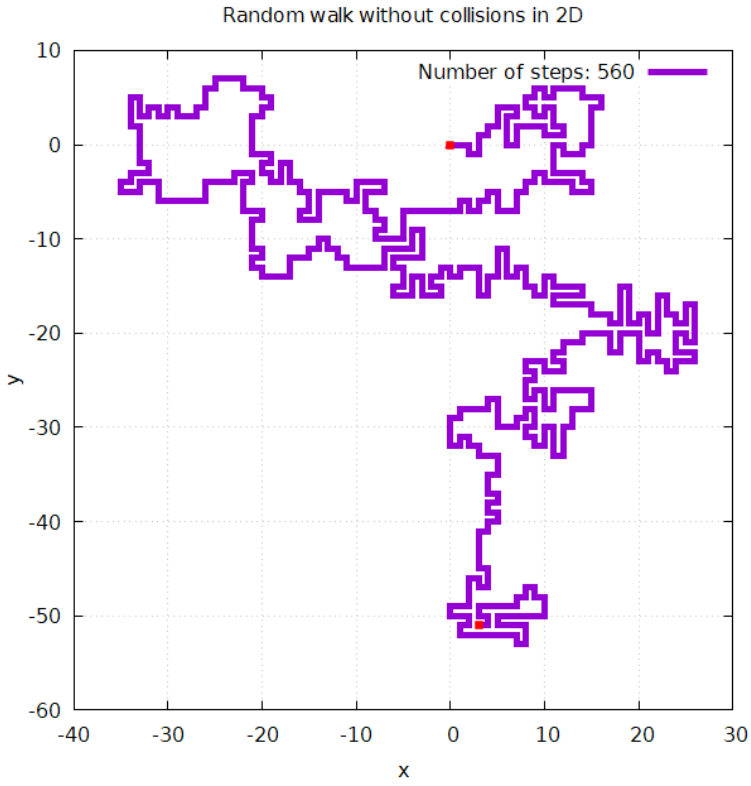


Figure 3.1: Example of non-crossing random walk.