

# Lab 3

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## 1 Monte Carlo Methods

let's review the inverse transform...

How would you produce random numbers that follow a triangular distribution:

$$f(x) = \frac{2}{a} \left(1 - \frac{x}{a}\right) \quad (1)$$

for  $x \in [0, a]$ ?

Monte Carlo methods are algorithms relying on repeated random sampling to compute results. Monte Carlo is used when it is infeasible to compute an accurate result with a deterministic model.

The classic first step to learning Monte Carlo methods is the random walk. This is a formalization of measuring the trajectory of taking random successive steps in any direction. Random walks are observed in natural processes such as electron transport, lymphocytes through lymph nodes, and Brownian motion.

Properties of the Random Walk

1. Single dimension: e.g.: coin toss
2. Two dimensions: e.g. up, down, left, right
3. Three dimensions: e.g.: up, down, left, right, oblique up, oblique down

**Problem** Simulate a random walk in two dimensions. The stepper will have a step size of 1mm. Generate whole integers randomly between [1,4] assigning directions to each of the whole integers. Make 500 walkers take 1000 steps and plot the result.

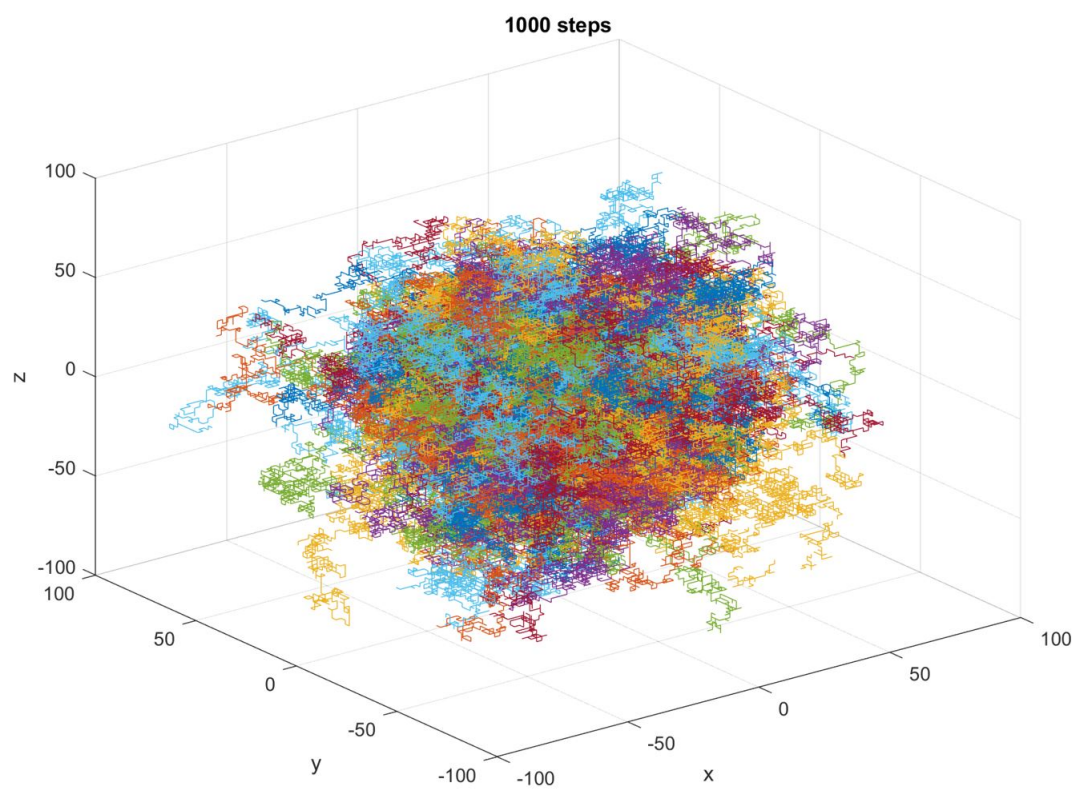


Figure 1: Result of random walkers