

Random Walk

* Stochastic Process for determining the probable location of a point subject to random motions, given the probabilities of moving some distance in some direction

(Britannica definition)

* Process by which randomly moving objects wander away from where they started.

Simple example : 1D random walk on the integers

Start at 0, move $+1/-1$ with 50% chance

Random walks used to represent :

1. Path of a molecule in a gas/liquid (Brownian motion)
2. Path of an animal looking for food
3. Short term fluctuating stock
4. Diffusion limited aggregation - tie with ABM

See Wikipedia for wide range of applications.

In ABM we can model processes / agent behavior using random walks

To come:

Random walk in 2D

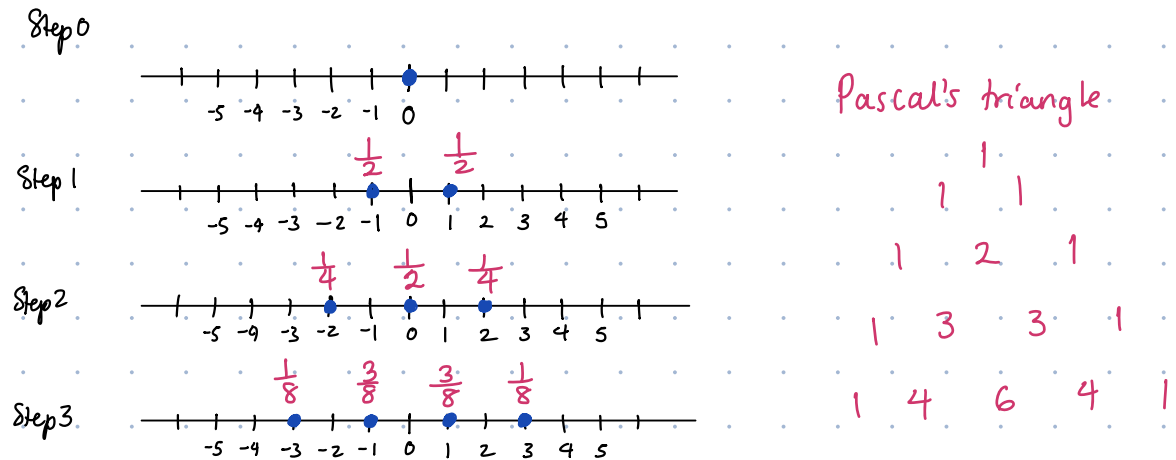
Lévy Flight, random walk with step lengths from Lévy distribution

probability distribution that is heavy tailed.

Simulated annealing

Today Random Walks in 1D on integers

1. At each step move ± 1 with equal probability (not biased)
2. Steps are independent (Markov chain)



Take n steps

Develop pseudocode \rightarrow Pull codes from Github

1. What is the expected value of the last position after n steps? Intuitively the particle is most likely to be at zero. Equal chance of moving in both directions.

2. How far does the particle travel after n steps?

this changes each time we run the experiment so what do we do?

Monte Carlo Simulation

Repeat experiment N times find how far particle would have traveled on average. (spread)

discuss functions & nested functions.

Activity

Plot histogram, find mean, find variance, find Standard deviation

Do experiment with different number of steps

Key takeaways

* Standard deviation / spread = \sqrt{n}

* More steps means less chance of coming back to center position

* Histogram gives an approximate representation of probability distribution

$\text{randperm}(N, K)$ - return a row vector containing K unique integers selected randomly from $1:N$.

$\text{randperm}(2, 1)$ one integer between 1 & 2
 \swarrow \nwarrow one number
 1:2

equivalent $\text{randi}(2)$