

Lab 1
Computational Physics
MC Simulation Technique: Random Walk

Note: Symbols carry their usual meanings.

1. Perform a series of simple **Random Walk** (RW) simulations on 2-dimensional lattice (lattice spacing: $\Delta x = \Delta y = 1$ unit) to estimate the *mean squared end to end distance*, $\langle R^2(N) \rangle \propto N^\nu$. Plot the trajectory of any random sample; Plot the averaged data for $\langle R^2(N) \rangle \propto N^\nu$ on a logarithmic scale and compute the size exponent ν . The theoretical value of $\nu = 1$ in 2 and 3-dimensions.

Algorithm for N steps RW:

- a. start from origin ($x = 0, y = 0$), and set $i = 0$
 - b. select a random integer between 1 and 4
 - c. set $x = x \pm 1$ and $y = y \pm 1$, and $i = i + 1$
 - d. when $i = N$ stop the loop
 - e. compute the square of end to end distance: $R^2 = x^2 + y^2$
 - f. compute the average $\langle R^2(N) \rangle$
 - g. store the data and plot it
2. Perform Question (1) on a 3-dimensional lattice.