

# PHYS 160 - Assignment # 6

Due: Friday, March 11, 2016

The Brownian motion is the zigzag motion of small objects in suspension in a liquid. It was known to exist in early 1900. Einstein recognized that these zigzag trajectories were akin to random walks followed by the small objects. He then postulated that the liquid contained molecules that collided with the small objects, thereby causing a large momentum transfer, an impact, that could change sharply the momentum of the small object in magnitude and/or direction.

In this assignment, you are to generate *many* random walks of diverse numbers of steps. Then you should *guess*, and *demonstrate numerically*, the best relation between the distance traveled by a *drunken man (random walk)* in relation to the number of steps.

You should follow the following steps:

1. Complete and test your version of the program that we developed at lecture time to generate *random walks* of arbitrary number of steps. The walks are generated on an equally spaced square lattice.
2. Use this program to generate random walks with various number of steps: 500, 700, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000.
3. Launch a total of 130 walks, with different number of steps distributed at random among the walks. but with not less than 10 walks for any given number of steps.
4. Calculate the distance between the initial position and the last step taken for each walk. Record these distances and the corresponding number of steps for each walk.
5. Plot the raw data, i.e., the *distance* versus the *No steps* for all the walks in one graph.
6. Perform a list-square-fit of the distance versus the number of steps for diverse functional relations.
7. Plot the fitted relation (*distance-raw data*) and the raw data
8. Which mathematical function best fits the raw data of *distance* versus the *No steps*
9. Calculate the variance for the fits you are trying. Confirm mathematically which fits is the best.