



Random Walks

Learning Objective

Now that we have an idea of how to use the computer to generate pseudo-random numbers, we explore how to use these numbers to incorporate the element of chance into simulations. We do this first by simulating a random walk and in another module by simulating an atom decaying spontaneously. Both applications are good examples of how a computer can simulate nature and thereby permit the computer to be used as a virtual experimental laboratory.

Science and Math content objective:

- Students will better understand how chance enters into natural processes.
- Students will see how an approximate mathematical description can be developed of a natural process containing chance.
- Students will learn how a computer can simulate nature and thereby permit the computer to be used as a virtual experimental laboratory.

Scientific skills objective:

- Students will practice the following scientific skills:
 - Graphing (visualizing) data as (x,y) plots.
 - Discerning relations between variables in data containing statistical fluctuations.
 - Testing the reasonability, if not correctness, of a simulation by comparing it with a mathematical relation.

Activities

In this lesson, students will:

- Develop a mathematical model for a stochastic process.
- Develop an algorithm to simulate a stochastic process.
- Use a computer program to generate random numbers.
- Examine the random walks produced by a simulation.

- Test the reasonability, if not correctness, of a simulation by comparing it with a mathematical relation.

Related Video Lectures (Upper-Division Undergraduate)

1. Random Numbers for Monte Carlo

science.oregonstate.edu/~rubin/Books/eBookWorking/VideoLecs/MonteCarlo/MonteCarlo.html

2. Monte Carlo Simulations

<http://science.oregonstate.edu/~rubin/Books/eBookWorking/VideoLecs/MonteCarloApps/MonteCarloApps.html>