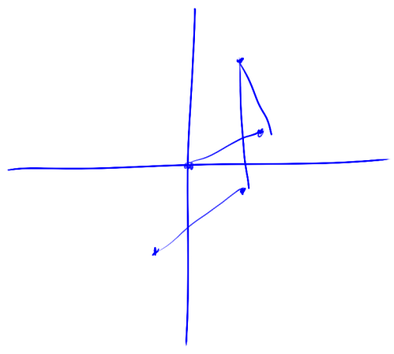
prob.exe Exercises for Chapter prob

Exercise prob.5

Several physical processes can be modeled with a random walk: a process of interatively changing a quantity by some random amount. Infinitely many variations are possible, but common factors of variation include probability distribution, step size, dimensionality (e.g. one-dimensional, two-dimensional, etc.), and coordinate system. Graphical representations of these walks can be beautiful. Develop a computer program that generates random walks and corresponding graphics. Do it well and call it art because it is.



$$aeb = a \times 10^b$$

$$54e3 = 54 \times 10^3 = 54000$$

$$R = 47\ M\Omega = 47e6\ \Omega$$

$$C = 0.1\ \mu F = 0.1e-6\ F$$

stats

Statistics

Whereas probability theory is primarily focused on the relations among mathematical objects, statistics is concerned with making sense of the outcomes of observation (Steven S. Skiena. Calculated Bets: Computers, Gambling, and Mathematical Modeling to Win. Outlooks. Cambridge University Press, 2001. DOI: 10.1017/CBO9780511547089. This includes a lucid section on probability versus statistics, also available here: https://www3.cs.stonybrook.edu/~skiena/jaialai/excerpts/node12.html.).

estimation

However, we frequently use statistical methods to estimate probabilistic models. For instance, we will learn how to estimate the standard deviation of a random process we have some reason to expect has a Gaussian probability distribution.

Statistics has applications in nearly every applied science and engineering discipline. Any time measurements are made, statistical analysis is how one makes sense of the results. For instance, determining a reasonable level of confidence in a measured parameter requires statistics.

machine learning

A particularly hot topic nowadays is machine learning, which seems to be a field with applications that continue to expand. This field is fundamentally built on statistics.

A good introduction to statistics appears at the end of Ash.[1] A more involved introduction is given by Jaynes andothers.[2] The treatment by Kreyszig[3] is rather incomplete, as will be our own.

1. Ash, Basic Probability Theory.

2. Jaynes andothers, Probability Theory: The Logic of Science.

3. Erwin Kreyszig. Advanced Engineering Mathematics. 10th. John Wiley & Sons, Limited, 2011. ISBN: 9781119571094. The authoritative resource for engineering mathematics. It includes detailed accounts of probability, statistics, vector calculus, linear algebra, fourier analysis, ordinary and partial differential equations, and complex analysis. It also includes several other topics with varying degrees of depth. Overall, it is the best place to start when seeking mathematical guidance.