Material for Week 2
Physics 4488/6562: Statistical Mechanics
http://www.physics.cornell.edu/sethna/teaching/562/
Exercises due Mon. Feb 03
Last correction at March 12, 2020, 4:48 pm

All exercises are from Version 2.0 of the text: http://pages.physics.cornell.edu/~sethna/StatMech/v2EntropyOrderParametersComplexity.pdf

Monday
In-class question: 2.2 *Photon diffusion in the Sun*
In-class question: 2.23 *Random walks and generating functions*
Wednesday
Read: Chapter 2, Sec. 2.3 (Currents and forces)
Pre-class question: 2.17 *Local conservation*
In-class question: 2.15 *Diffusion of non-conserved particles*
In-class question: 2.16 *Density dependent diffusion*
Friday
Read: Chapter 2, Sec. 2.4 (Solving: Fourier & Green)
Pre-class question: 2.18 *Absorbing boundary conditions*
In-class question: 2.6 *Fourier and Green*
Monday
Read: Chapter 3, Sec. 3.1 (Microcanonical) and 3.2 (Ideal Gas)
Pre-class question: 3.13 *Weirdness in high dimensions*

Exercises

Everyone (4488 and 6562)

2.5 *Generating random walks.* Hints are available in Python, Mathematica, and Matlab at http://pages.physics.cornell.edu/~sethna/StatMech/ComputerExercises.html.

8.4 *Red and green bacteria.* Analyze the system as a random walk in the number of red bacteria. Full credit for sensible arguments that get within a factor of two of the right answer. (Assigned to me for my qualifying exam at Princeton.)

2.11 *Stocks, volatility, and diversification.* Stock prices are pretty well approximated as random walks, but have 'fat tails'. Hints are available in Python, Mathematica, and Matlab at http://pages.physics.cornell.edu/~sethna/StatMech/ComputerExercises.html.

Graduate (6562 only)

2.21 *Lévy flight.* What happens when our random steps can have very large jumps?

2.19 *Run and tumble.* Here we study the eating strategies of bacteria. When to sit and wait for food to come by? How long to keep swimming, and when to turn?