Material for Week 1

Physics 4488/6562: Statistical Mechanics

https://sethna.lassp.cornell.edu/Teaching/562/

Exercises due Mon. Jan 31

Last correction at January 11, 2022, 9:02 pm

Before class, read the assigned material. Pre-class questions are due 8:00am on the morning before class on days when homeworks are not due (usually Wednesdays and Fridays), and otherwise should be turned in with the homeworks. Emergent vs. fundamental, is due *tomorrow evening.* If you are not registered for the class, sign up on the sheet today, and we'll add you to the Canvas site tonight.

All exercises are from the second edition of the text: https://sethna.lassp.cornell.edu/StatMech/EntropyOrderParametersComplexity20.pdf

Monday
In-class question: 1.4 *Stirling's formula*
Wednesday
Read: Chapter 1, What is Statistical Mechanics?
Pre-class question: 1.11 *Emergent vs. fundamental*
In-class question: 1.1 *Quantum dice and coins*
Friday
Read: Chapter 2, Sec. 2.1 (Random walk universality), Sec. 2.2 (Diffusion eqn)
Pre-class question: 2.1 *Random walks in grade space*
In-class question: 2.2 *Photon diffusion in the Sun*
In-class question: 2.23 *Random walks and generating functions*
Monday
Read: Chapter 2, Sec. 2.3 (Currents and forces)
Pre-class question: 2.17 *Local conservation*

Exercises for everyone (4488 and 6562)

1.5 *Stirling and asymptotic series.*
Do the lowest couple of orders in part (d) by hand. If you want to go to high orders, use the hints file (available for Mathematica and Python).

1.13 *The birthday problem.* A classic exercise illustrating a law emerging at large numbers of classmates.

Exercises for Graduate Course (6562 only)

1.6 *Random matrix theory.* Hints are available in Python and Mathematica at https://sethna.lassp.cornell.edu/StatMech/EOPCHintsAndMaterials.html

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