Material for Week 1

Physics 4488/6562: Statistical Mechanics
https://sethna.lassp.cornell.edu/Teaching/562/
Exercises due Mon. Jan 29
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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. Python and Mathematica hints for computational exercises at https://sethna.lassp.cornell.edu/StatMech/EOPCHintsAndMaterials.html.

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

1.13   *The birthday problem.* New law emerges for large classes.

Select zero − one (4488) or one − two (6562)

1.14   *Width of the height distribution.* (Statistics) A modern view of the $1/\sqrt{N-1}$ factor in the standard deviation formula.

1.5   *Stirling and asymptotic series.* (Mathematics,Computation) Do the lowest couple of orders in part (d) by hand, or use the hints file.

1.6   *Random matrix theory.* (Mathematics, Quantum, Computation). Use the hints file!

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

1.9   *First to fail: Weibull.* (Mathematics, Statistics, Engineering) Extreme value statistics.

1.12   *Self-propelled particles.* (Active matter) Self-propelled particles and the onset of flow.