Material for Week 4
Physics 4488/6562: Statistical Mechanics
https://sethna.lassp.cornell.edu/Teaching/562/
Exercises due Wed. Feb 19
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Exercises marked N#.## are available at
https://sethna.lassp.cornell.edu/StatMech/SethnaExercises.pdf.

Enjoy your break next Monday.

Monday
In-class question: 5.4 *Black hole thermodynamics*
In-class question: 5.22 *The Dyson sphere*
Wednesday
Read: Chapter 5, Sec. 5.2.2 (Residual entropy of glasses)
Pre-class question: 5.18 *Entropy of socks*
In-class question: 5.12 *Rubber band*
In-class question: 5.23 *Entropy of the galaxy*
Friday
Read: Chapter 5, Sec. 5.3.1 (Entropy as ignorance: Non-equilibrium)
Pre-class question: 5.19 *Aging, entropy, and DNA*
In-class question: 5.13 *How many shuffles?*
Wednesday
Read: Chapter 5, Sec. 5.3.2 (Information entropy)
Pre-class question: 5.20 *Gravity and entropy*

Assigned exercise for everyone

5.11 *Entropy of glasses.* (Condensed matter) You can count the number of glass atomic configurations experimentally!

Special topic exercises (6562 do one; 4488 do 7 during 14 weeks)

4.4 *Jupiter! and the KAM theorem.* (Astrophysics, Mathematics, Computation, Dynamical systems) The solar system is not ergodic. Why? Hints at https://sethna.lassp.cornell.edu/StatMech/EOPCHintsAndMaterials.html

5.2 *Burning information and Maxwellian demons.* (Computer science), Can we burn information as fuel? Is entropy *fungible* (convertable between information and work)?

5.7 *Does entropy increase?* (Mathematics) Physics is time-reversal invariant. How can entropy increase as time moves forward? Liouville's theorem shows $dS_{\mathrm{micro}}/dt = 0$

5.25 *Equilibration in phase space.* How stirring increases the entropy. (It's subtle.)

N1.3 *Accelerators vs. ergodicity.* (Accelerator,Mathematics) Synchrotrons push particles around billions of orbits with nonlinear magnets. Why don't the particles escape the beam? (Similar to Jupiter: don't submit both.) Hints at https://sethna.lassp.cornell.edu/StatMech/EOPCHintsAndMaterials.html