Syllabus for Statistical Physics, PY-410

Instructor: Pankaj Mehta- pankajm@bu.edu, SCI 323,
Grader: Ching-Hao Wang - chinghao@bu.edu, SCI 314

Office hours: Wednesdays 3:30pm - 4:30pm or by appointment.

Recommended textbooks:

- Main Text: J Sethna, "Statistical Mechanics: Entropy, Order Parameters, and Complexity". We will cover Chapters 1-3,5-7,9.
  Available free: `http://pages.physics.cornell.edu/~sethna/StatMech/`.
- Additional text: F. Reif, "Fundamentals of Statistical and Thermal Physics", Waveland Press, Long Grove, Illinois 2009 (first issue 1965).
- Additional text: D. Schroeder. "An introduction to thermal physics"
- Additional text: M. Kardar, "Statistical Physics of Particles", Cambridge University Press, 2007.
- Additional text: L. Landau and L. Lifshitz, "Statistical Physics" vol. V., Butterworth-Heinemann; 3rd edition (April 1984)

Grading, Exams, and Homeworks:

- Homework: Homework assignments are given on Thursday and due back by the second Tuesday (you have about 12 days). Late homeworks are accepted with 20% penalty for another two days unless there is a valid excuse.
- Programming: Please note: there will be at least one HW problem a problem set that requires you to program. These HW problems can be done in Python using provided notebook.
- Exams and Grading: There will be two take-home midterms and one final exam. The distribution of grades is: home works - 50%, midterms - 50% each, final exam - 20%.

Topics to be covered:

- Basics of probability and statistics: probability distributions, statistical averages, law of large numbers, random walk, examples of various distributions.
- Basic postulate of statistical mechanics, Interactions between macroscopic systems: energy, heat, work.
- Statistical thermodynamics: irreversibility, temperature, entropy, heat reservoir, laws of thermodyanmics
- Statistical ensembles. Boltzmann's distribution. Partition function. Statistical definition of thermodynamic potentials. Von Neumann's entropy.
- Applications of statistical physics: ideal gases, general relations in thermodynamics, heat engines and refrigerators, equipartition theorem and applications to solids, monoatomic molecules, black body radiation etc.
- Relationship of statistical physics to data science/machine learning/information theory