

PY 541 Problem Set 1: HW Exercises Due on Tuesday Sept. 20th

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September 12, 2022

Read the assigned material before class. Pre-class questions are due midnight the night before before Tuesday and Thursday classes and noon on Wednesdays when homeworks are not due (usually Tuesdays), and otherwise should be turned in with the homeworks.

Welcome to PY 541 Statistical Physics. This is a graduate course that assumes you have taken an undergrad course on these topics (e.g. Thermal Physics, Statistical Physics, etc.). It also assumes some basic familiarity with core mathematical areas: probability, linear algebra, vector calculus as well as rudimentary programming skills (Python, Mathematica, etc.). If you do not feel comfortable with these concepts, please come talk to me.

All exercises are from the second edition of Jim Sethna's book available at:

<https://www.lassp.cornell.edu/sethna/StatMech/index.html>.

There are also hints and code for computational exercises at this website.

Readings and Pre-class questions

Tuesday 9/6:

In-class question: 1.3 Waiting time paradox.

Wednesday 9/7:

Read: Chapter 1, What is Statistical Mechanics?

Pre-class question: 1.11 Emergent vs. fundamental

In-class question: Probability and generating functions

Thursday 9/8:

Pre-class Question: 1.10 Emergent Behaviors

In-class questions: 1.1 Quantum dice and coins

Tuesday 9/13:

Read: Chapter 2, Sec. 2.1-2.2, Random walk universality; Diffusion

Pre-class question: 2.1 Random walks in phase space

In-class question: 2.2 Photon diffusion in the Sun

In-class question: 2.23 Random walks and generating functions

Wednesday 9/14 :

Read: Chapter 2, Sec. 2.3 (Currents and forces)

Pre-class question: 2.17 Local conservation.

In-class question: 2.15 Diffusion of nonconserved particles

Thursday 9/15 :

Read: Chapter 2, Sec. 2.4

Pre-class question: 2.18 Absorbing boundary conditions

In-class question: 2.16 Density dependent diffusion

In-class question: 2.6 Fourier and Green

Homework Exercises

All hints are available at: <https://www.lassp.cornell.edu/sethna/StatMech/EOPCHintsAndMaterials.html> or ask me directly.

1. 1.6 Random matrix theory. Use hints file.
2. 1.13 The birthday problem. A classic exercise illustrating a law emerging at large numbers of classmates.
3. 1.15 Fisher Information
4. 2.21 Levy flight. What happens when our random steps can have very large jumps?

Honor Code

All students are expected to follow the [BU Honor Code](#). While collaboration is allowed and encouraged on HWs, each student should write up their own solutions. Copying HW is strictly forbidden. The students are allowed to consult all resources and books. However, students are NOT allowed to consult problem solutions from previous years or as found on the web.