

Homework 5

CS 574: Randomized Algorithms, Fall 2025

Due: Thursday, Dec 11th 2025 at noon

Instructions and Policy:

- Each homework can be done in a group of size at most two. Only one homework needs to be submitted per group. However, we recommend that each of you think about the problems on your own first.
- Homework needs to be submitted in pdf format on Gradescope. See <https://courses.grainger.illinois.edu/cs374a11/sp2025/hw-policies.html> for more detailed instructions on Gradescope submissions.
- Follow academic integrity policies as laid out in student code. You can consult sources but cite all of them including discussions with other classmates. Write in your own words. See the site mentioned in the preceding item for more detailed policies.

Problem 1. Exercise 5.5 in Motwani-Raghavan book via the probabilistic method. The instructor used this construction to prove a nice integrality gap result for a scheduling problem based on the suggestion of his advisor Rajeev Motwani.

Problem 2. Exercise 6.19 and/or 6.20 from Mitzenmacher-Upfal book on the use of LLL.

Problem 3. We have seen the notion of VC-dimension and proved the ϵ -approximation theorem. We stated but did not prove the ϵ -net theorem which provides a weaker guarantee but has a stronger guarantee on the number of samples. To understand the subtle proof technique solve Exercise 13.2 in Kent Quanrud's notes.

Problem 4. Exercises 5.11 and/or 5.13 from the Foundations of Data Science on PAC learning.