CS7800: Advanced Algorithms
Homework 5: Due Tuesday, November 11 2025

Fall 2025

Jonathan Ullman

Assigned Problems (Collected and Graded)

Problem 1 In the HITTINGSET problem, we are given a number k and a collection of subsets $A_1, \ldots, A_m \subseteq \{1, \ldots, n\}$ and our goal is to determine if there exists a hitting *hitting set* $H \subseteq \{1, \ldots, n\}$ of size at most k such that H contains at least one element from every subset A_i. That is, we want $|H| \leq k$ and $H \cap A_i \neq \emptyset$ for every $i = 1, \ldots, m$.

Prove that HITTINGSET is NP-complete.

Problem 2 In the ZEROWEIGHTCYCLE problem, we are given a directed graph, weighted graph $G = (V, E, \{w_e\})$ and the goal is to decide if G contains a cycle of weight 0. That is, a cycle of edges C such that $\sum_{e \in C} w_e = 0$.

Prove that ZEROWEIGHTCYCLE is NP-complete.[1]

Optional Problems (Not Collected and Not Graded)

I will suggest some optional review problems that I like on Piazza later in the week.

---

[1]**Hint:** Try reducing SUBSETSUM to ZEROWEIGHTCYCLE.