CS420+500: Advanced Algorithm Design and Analysis

Lectures: March 13 + March 15 (midterm), 2017

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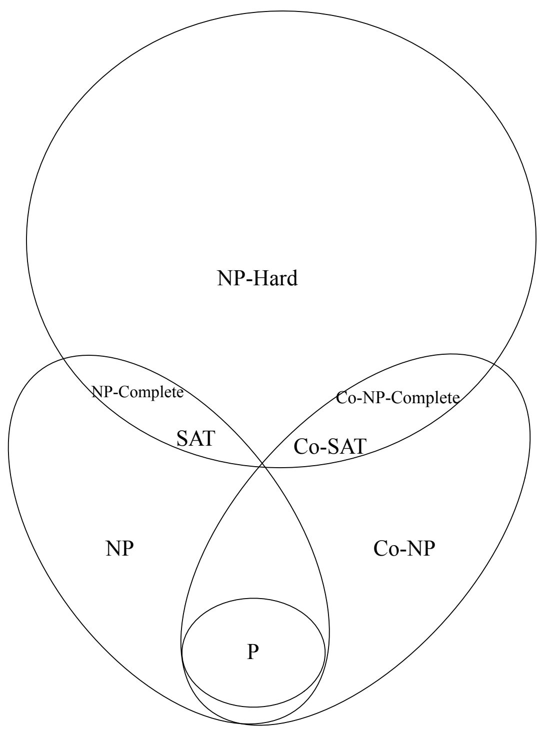
1 Review: SAT and Witnesses

Conjunctive normal form: $\phi = (x \vee y \vee z) \wedge (\bar{x} \vee \bar{t}) \wedge (x \vee \bar{z})$. It's the "AND" (the conjunction) of a set of "OR" clauses.

- $\phi \in$ SAT $\equiv \phi$ has a satisfying (true) assignment.
- A witness is a true assignment.
- $\phi \in$ Co-SAT $\equiv \phi$ has no satisfying true assignment if and only if $\bar{\phi} \in$ SAT.
- L is NP-complete $\equiv L$ is in NP and L is NP-hard.

Briefly reviewed the relationship between complexity classes:



One question led to another and we started talking about *polynomial hierarchy*, which was interesting (but doubtful as an examinable topic). A clear notes corresponding to this discussion were not provided so perhaps refer to Wikipedia entry (`https://en.wikipedia.org/wiki/Polynomial_hierarchy`) as a starting point if interested in the details.

2 Apprxomiation Algorithms for Optimization Problems

An algorithm A is a ρ-approx algo if for every input I with optimal solution value $\mathrm{OPT}(I)$:

$$\frac{A(I)}{\mathrm{OPT}(I)} \leq \rho.$$

Note: the above definition assumes that the optimization problem is to minimize some objective. If the objective is to maximize, then we say that A is a ρ-approx algo if for every input I with optimal solution value $\mathrm{OPT}(I)$:

$$\frac{\mathrm{OPT}(I)}{A(I)} \leq \rho.$$