Chapter 0.

Course Plan

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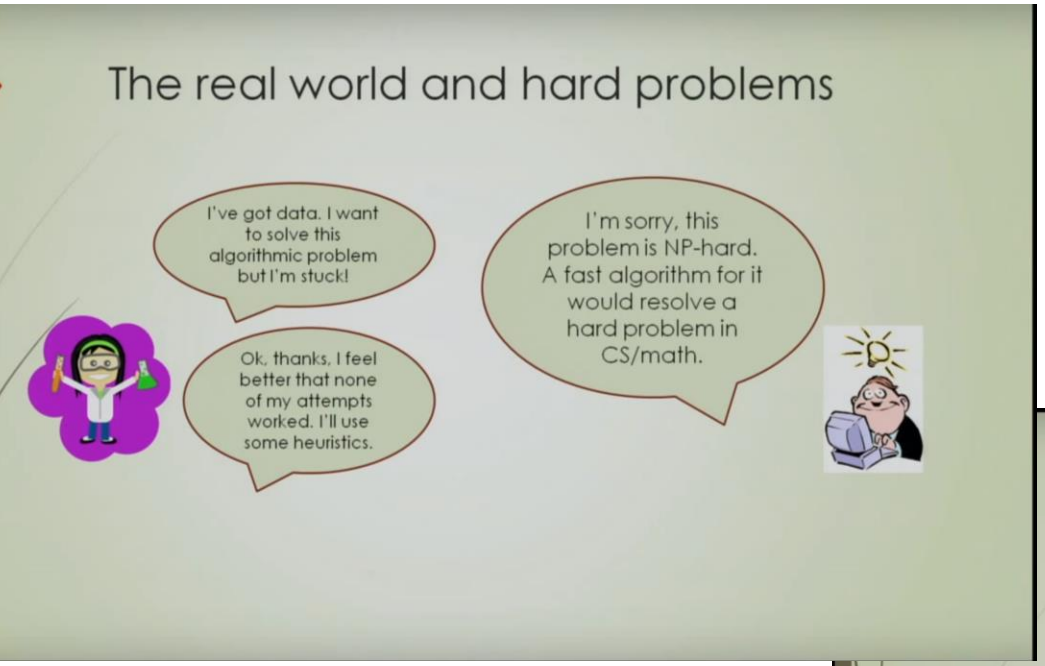
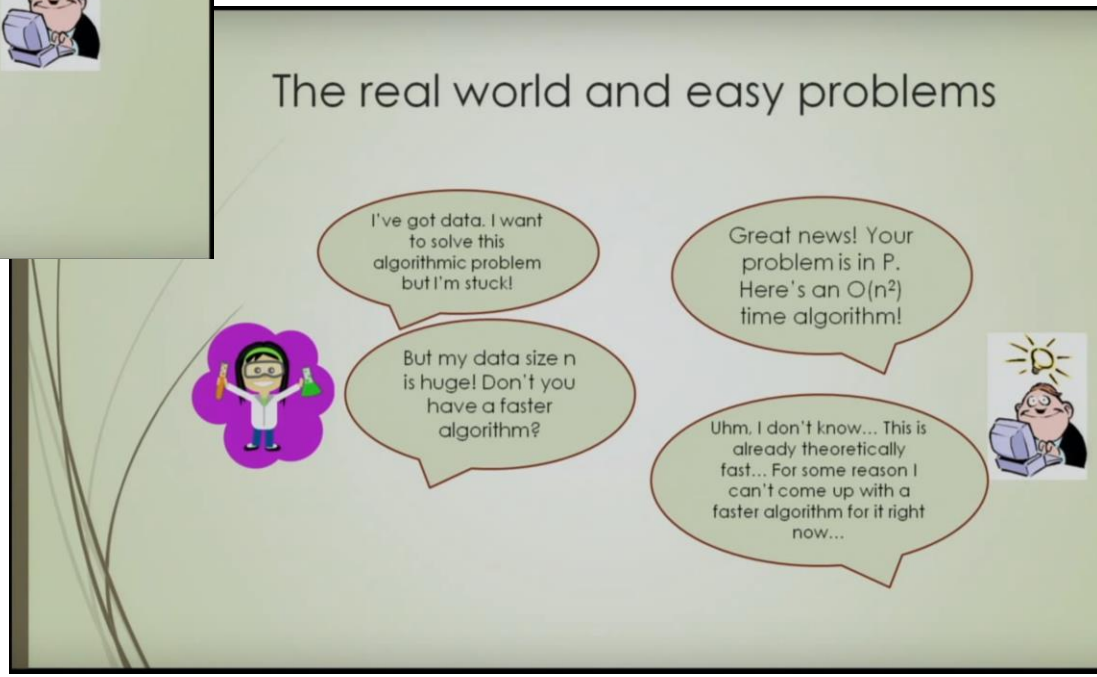
Goal

Lower bounds for dynamic problems based on various conjectures.

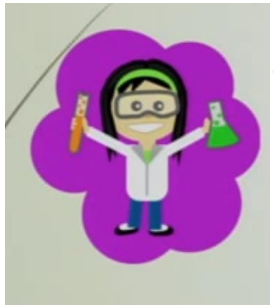
Fine-grained Complexity & **Static** Problems





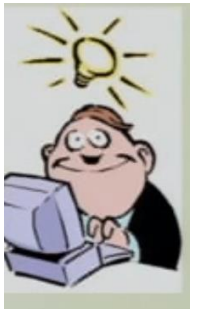
Source: [Fine-Grained Complexity and Algorithm Design Boot Camp](), by Virginia Williams, 2015

Fine-grained Complexity & **Dynamic** Problems



I want to analyze this **evolving data** but I'm stuck.

There is a lower bound of $\boldsymbol{\Omega(\log^2 n)}$ in cell-probe



But $O(\log^5 n)$ will be good enough

Sorry, we don't know how to prove big cell-probe lower bounds, and there is no such thing like NP-hardness …

Rough Plan

1. Introduction to dynamic algorithms
   - Update & Query Time
   - Incremental/Decremental Algorithms
   - Amortization & Empty-start assumption
   - Randomization & Oblivious-adversary assumption
2. Lower bounds based on the OMv conjecture
3. Other conjectures
   - SETH, OV, dynamic OV, BMM, 3SUM, APSP, Multiphase, etc.

Optional:

- Unconditional lower bounds
- Hardness of FPT-approximation (GapETH-, W[1]-hardness, etc.)

Questions?

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