CS120: Intro. to Algorithms and their Limitations Anshu & Hesterberg

Lecture 25: Conclusions

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1 Announcements

Recommended Reading:

- Roughgarden IV, Epilogue
- MacCormick, Chapter 18

2 An Algorithmicist's Workflow

When confronted with a real-world algorithmic problem (like Web Search, Interval Scheduling, Deduplication, Census Data Releases, Google Maps, Kidney Exchange, Lyber, "Magic Maze", Register Allocation/Map Coloring, Programming Team, ArithmeticOverflow, ArtemisParty, ...), you can tackle it using the skills from cs120 (and future classes) by looping through the following steps:

1. Mathematically model

2. Look for related problems (in class, in the literature, on the web) and try to obtain an algorithm by **reduction to** another problem:

3. Try to obtain an algorithm by **reduction to** other problems

4. Try to apply **algorithmic techniques**

5. Try to show hardness/unsolvability by **reduction from** other problems

6. And/or settle for weaker guarantees

3 Other Takeaways

- Universality

- Rigorous mathematical theory

- There is much we don't know!

4 CS120 Learning Outcomes

From the Syllabus: "By the end of the course, we hope that you will all have the following skills:

- To mathematically abstract computational problems and models of computation
- To design and implement algorithms using a toolkit of algorithmic techniques
- To recognize and formalize inherent limitations of computation
- To rigorously analyze algorithms and their limitations via mathematical proof
- To appreciate the technology-independent mathematical theory of computation as an intellectual endeavor as well as its relationship with the practice of computing."

5 Where to Learn More

- Theory of Computation seminar: http://toc.seas.harvard.edu/
- Many other CS courses, especially x2x. Look at grad (2xx) courses too. (CS120 may serve as a sufficient substitute for CS121/CS124 in some of them.)
- Read more of our textbooks (Roughgarden, MacCormick, CLRS, and the references therein)
- Come talk to us in office hours!