Where to Go from Here
Outline for Today

• **Where We've Been**
  • What did we cover this quarter?

• **Your Questions**
  • Questions on any topics you'd like!

• **What Comes Next**
  • What's next in theory?

• **Final Thoughts**
  • Wrapping up the experience.
Where We've Been
Where We've Been

- Hybrid RMQ
- Fischer-Heun
- Aho-Corasick
- Suffix Trees
- Suffix Arrays
- B-Trees
- Red/Black Trees
- Augmented Trees
- Amortization
- Binomial Heaps
- Fibonacci Heaps
- Splay Trees
- Count(-Min) Sketches
- Linear Probing
- Cuckoo Hashing
- \{x, y\}-Fast Tries
- Fusion Trees
- Euler Tour Trees
- Dynamic Graphs
Key Theory Techniques from CS166

...with Relevant Life Advice.
Combine Expert Ideas

- **Recursion is a great idea, but sometimes different strategies combine together even better.**
  - Fischer-Heun RMQ
  - x-Fast and y-Fast Tries
  - The Prefix Parity Problem
- You don’t want all “big ideas” people running a government, nor do you want all “policy wonks.” A team of both is probably better.
Invest for the Future

- **Problems are rarely solved in isolation. Expect to do the same thing over and over.**
  - All of RMQ
  - Aho-Corasick Matchers
  - Suffix Trees
  - Suffix Arrays
  - Prefix Parity
- Quick fixes can work short term. Long-term investments pay huge dividends.
Be Lazy

- *Sometimes it's good to let messes accumulate a bit.*
  - Binomial heaps
  - Fibonacci heaps
  - Splay trees
  - Dynamic Graphs
  - \{x, y\}-Fast Tries
- There’s a reason we have dishwashers.
Change Representation

• Don't overtrain on how the data “has” to be stored. Look for other approaches.
  • 2-3-4 Trees and Red/Black Trees
  • Disjoint-Set Forests
  • Suffix Arrays
  • Euler Tour Trees and Dynamic Graphs
  • Fibonacci Heaps

• Question the basic tenets of why you do things the way you do. Structural reform is often more valuable than situational fixes.
Give Credit (and Blame) Fairly

- Don't blame everyone for a failure, and give proper credit for success.
  - Weight-Balanced Trees
  - Dynamic Graphs
- Teamwork is great – but be honest about whether you’re pulling your own weight!
Find Independence

- *Events in the real world are correlated. Find ways to add small degrees of independence.*
  - Cuckoo Hashing
  - Linear Probing
- Remember that life experiences are not i.i.d. You will be a much happier person.
Groups are (Often) Wise

- *Combine lots of small answers together into a much bigger one.*
  - Count-[Min] Sketches
  - Cardinality Estimators
  - $x$-Fast and $y$-Fast Tries
  - Fischer-Heun RMQ
- No one person has the solution to all life’s problems. Collectively, we have solutions to most of them.
Enjoy Diversity of Opinion

• You can get to the same place in many different ways.
  • Tries
  • Red/Black Trees
  • B-Trees
  • Splay Trees
  • y-Fast Tries
  • Fusion Trees

• Don't pigeonhole yourself into thinking there is “a” way to do something. Diversity of perspective is a good thing.
Look for Economies of Scale

- *Perform fewer, bigger operations rather than multiple, smaller operations.*
  - Fusion trees
  - Lazy binomial heaps
  - SA-IS
- It’s cheaper to buy in bulk.
Your Questions
Where to Go From Here
Can we do better?