

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

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***Can we do better?***