App Academy

Intro to Data Structures and Algorithms and Study Strategies

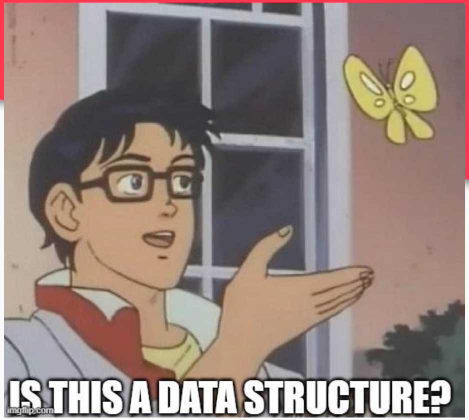
Let's set expectations

This workshop is meant to give you a solid foundation and framework to build upon. We will cover the most common patterns, but we cannot expect to be able to quickly master every pattern in different forms within two week's time. The content we cover will be extremely dense, and we will be moving VERY quickly.

Being able to recognize patterns quickly takes a LOT of practice and time, and there are NO SHORTCUTS.

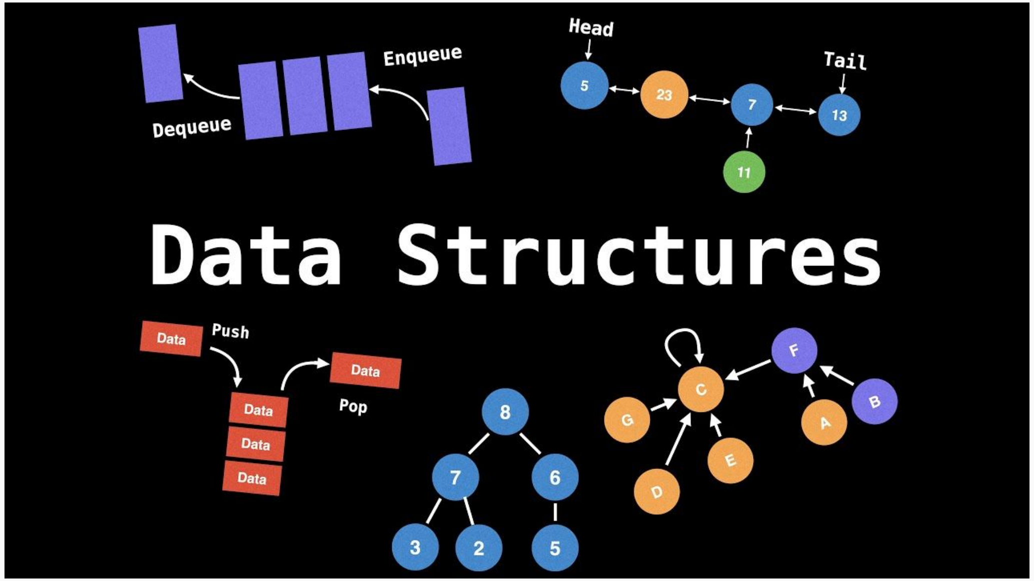
By the end of these two weeks, our goal is to understand what all our common tools are. To recognize when to use these tools will take time.

What are data structures and algorithms anyways...?



Data Structure and Algorithms

- A data structure is simply a way to to STORE data
  - examples:
    - Arrays
    - Hash tables
    - Hash sets
    - Linked Lists
    - Trees
    - Graphs
- Algorithms are ways to INTERACT with our data
  - The goal is to create, read, edit, or delete data in a way that is useful.
- We will look at this in the context of coding interviews
  - Design
  - Implementation
  - Trade offs



Why do I need to know this...?

- Helps us understand how efficient our solutions are in a measurable way.
- Use of good DS&A practices make your code more SCALABLE.
- Most importantly: IT'S ON THE INTERVIEW
  - Whether we agree or disagree with the efficacy of the process in finding good candidates is irrelevant. These are the rules of the game, and we have to play regardless.

Is this in? According to FIFA rulings, yes.

What is the best way to study DS&A?

History Lesson

- Blind 75
  - Leetcode Discussion
  - created by someone who did hundreds of Leetcode problems and found these 75 to be the most useful to him for reviewing fundamentals
  - some of these problems are VERY difficult for someone just starting though
- Neetcode
  - started by an unemployed aspiring software developer
  - slowly practiced over the course of a year and was able to get into Google
  - ordered things in a way that made sense (actually very similar to how Structy is formatted)

Three Different Ways to Study

1. Targeted Study
    - Choose a specific topic(s) and study problems from those topic(s)
2. Random Study
    - Choose randomly selected problems to solve
3. Mock Interviews
    - Solve a random problem under a time constraint in front of someone who asks you follow-up questions

Pros and Cons for each Study Strategy

	PROS	CONS
TARGETED STUDY	Allows you to repeat similar problems together to more easily see patterns that would indicate when to use a particular strategy.	You already have an notion of what kind of strategy to use, which isn't accurate to how a real-life interview works.
RANDOM STUDY	Forces you to read the prompt more carefully and practice noticing keywords and patterns in order to recognize what kind of strategy to use.	Many find it very difficult to see patterns for a particular topic when constantly switching around, especially when first starting out.
MOCK INTERVIEWS	Forces you to practice communicating your thoughts and manage your time, which are additional skills needed to succeed in an interview.	Can be time consuming and not time efficient when it comes to learning material.

You need to do ALL these consistently. How much time you dedicate to each one depends on what your current objectives are.

So where do we start?

- Arrays
- Hashing
- Linked Lists
- Recursion
- Sorting Algorithms
- Binary Search
- Trees
- Heaps
- Tries
- Graphs
- Dynamic Programming

The order that we do this is going to help tremendously!!! Everything builds upon one another!!

Do I really need to know all this?

- If you would like to succeed in the most difficult interviews: YES!!
- However, if you feel overwhelmed, start with mastering the following:
  - Arrays
  - Hashing
  - Linked Lists
  - Recursion
  - Sorting Algorithms
  - Binary Search
  - Trees
  - Graphs
- Heaps and Tries are not necessarily hard, but they are more niche data structures that don't come up as often. Dynamic Programming can be a very difficult topic if you do not master the other topics first.

Resources and Cheat Sheets

- Decision flowchart
  - A finite number of patterns and strategies can actually solve the vast majority of problems.
  - However, one of the most difficult parts of solving random DS&A problems is figuring out when to use certain patterns. This flowchart can help you figure out what strategies to think about for problems depending on what the problem is asking for.
- DS&A Starter Templates
  - These starter templates can solve a very large number of problems
  - Try to solve the problem first
    - Only refer to these templates for when you're completely stuck.
- These can be very powerful study tools, but be honest with yourself! Attempt the problems first! The goal is to eventually not be reliant on these resources.

Is it enough to solve the problem?

- We must UNDERSTAND and ANALYZE our solutions
- We must ensure that we can confidently communicate our ideas
- Track your progress! Memorize ideas and concepts, NOT solutions

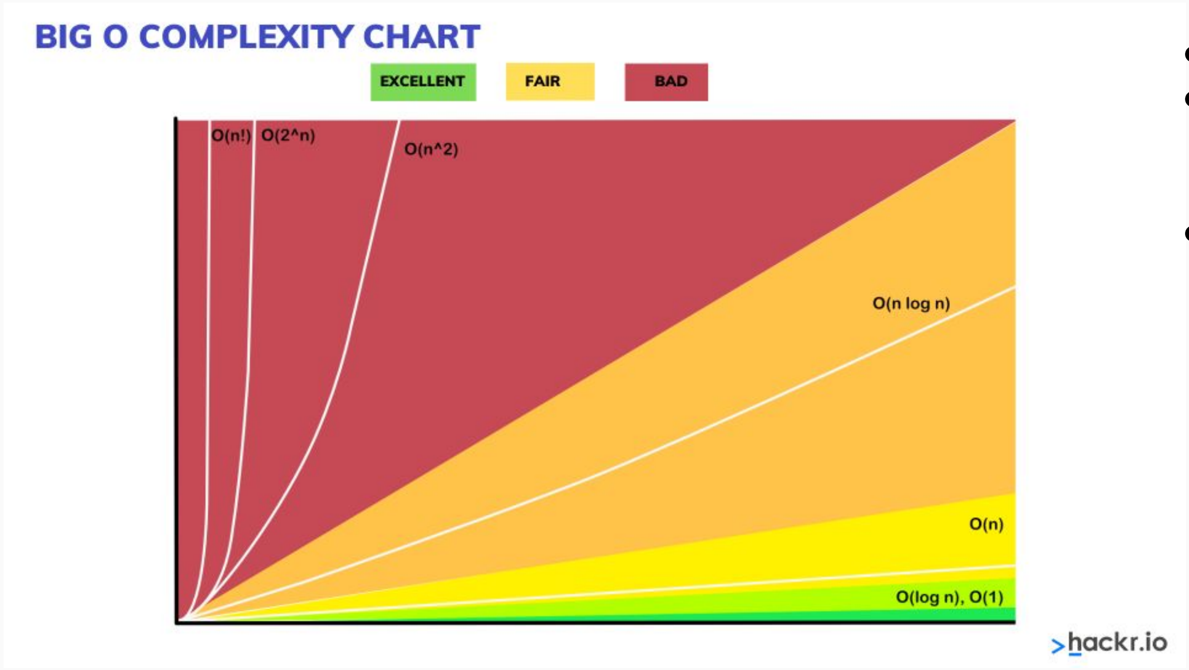
NO!

Tracking Progress

- Tracking progress and reflecting upon each problem is important!!
- I recommend revisiting problems if:
  - you could not solve without looking at the solution
  - you could not solve a problem within time limits
    - 15 min for easy, 30 min for medium, 45 min for hard
    - Note that the above times are VERY difficult to achieve when starting!! If you find it difficult to solve a mediums within 30min, 45 min is a reasonable time to shoot for.
    - The ultimate goal is to be able to solve any problem with enough time to spare for follow up questions during an interview.

- There are multiple ways to track your progress. I personally like to use Notion. You can download a template of my Notion setup here:
  - DS&A Tracking Notion Template
    - click "Duplicate" at the top to copy this template over to your own Notion account

Big O



- Big O is how we analyze our code
- Usually, we are concerned with the worst case scenario, though there are exceptions
- Our Big O analysis is based upon how our algorithm scales according to the input

How to get the most out of this workshop

- Participate!! You won't improve just by listening to lectures or reading slides.
- Turn on your camera. You will more often than not have interviews with cameras on, so let's practice being comfortable with yourself.
- Document your process! You should spend the last 5-10min of your pairboarding sessions writing a few short notes about the problem.
    - Reflect on every problem that you do, regardless of how easy or hard they are.
    - Mark down problems that you struggled with; return to them after a week so that it isn't fresh on your mind.
- Make connections! Did you enjoy working with your partner for the day? Ask if they would like to be a study partner even after Algo Academy.

Questions?