Algorithm Design & Analysis

Part 1: Introduction & Paradigms

What is an algorithm?

Computation

input → output

series of steps

What makes a *good* algorithm?

repeatable → consistent output

ease of implementation

efficiency - time & space

generalizable → handle enough inputs

wide coverage

→ handle errors or bad input

well-defined

accuracy

clearly defined input & output

What is a data structure and what makes a *good* data structure?

modular → dynamic

access to data → operations

well-defined

consistency

Why is it important to think about data structures when you are implementing an algorithm?

Does efficiency really matter?

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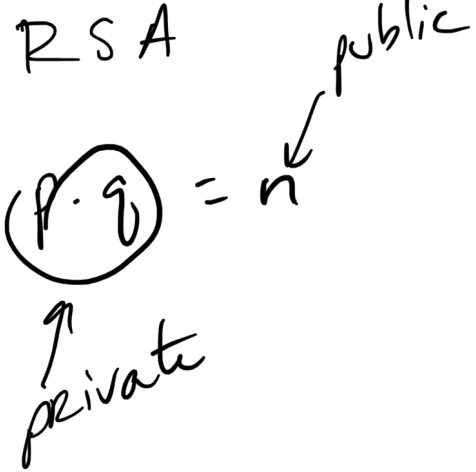
More efficient algorithms and data structures can…

- enable new research.
- enable new technology.
- enable faster response times for different applications.
- enable faster processing for large amounts of data.
- make it less likely that your program will crash.
- potentially break some cryptographic systems!
- make coding a little easier.



What are some algorithms and data structures you are already aware of and how would you describe them?

Sorting - Bubblesort, Quicksort, Mergesort, Bogo Sort, Insertion Sort

Graphs

Recursive Backtracking

Heaps

binary trees

Stacks & Queues

Algorithm Paradigms

Paradigm	Description	Example
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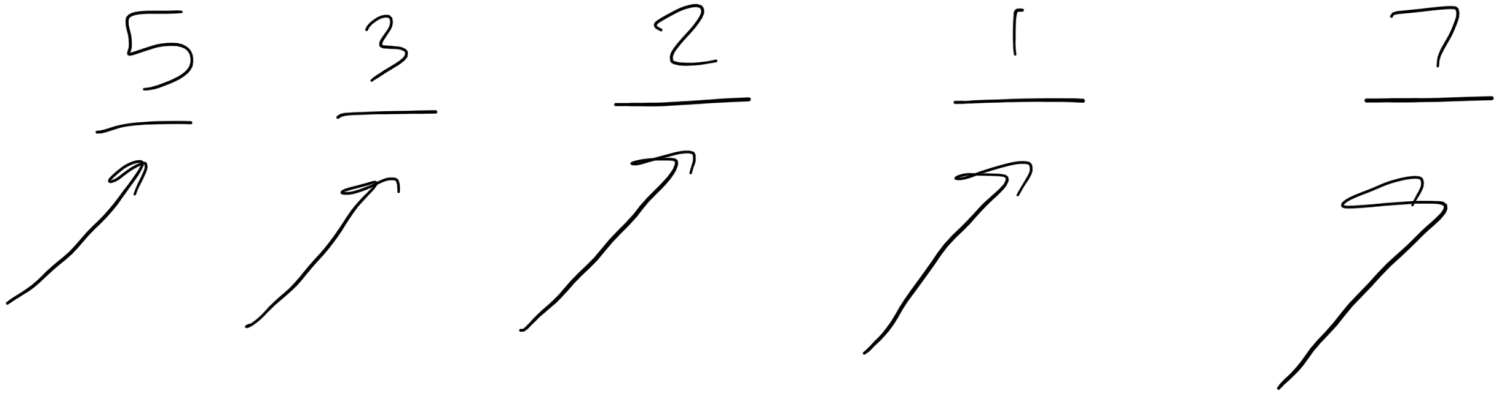

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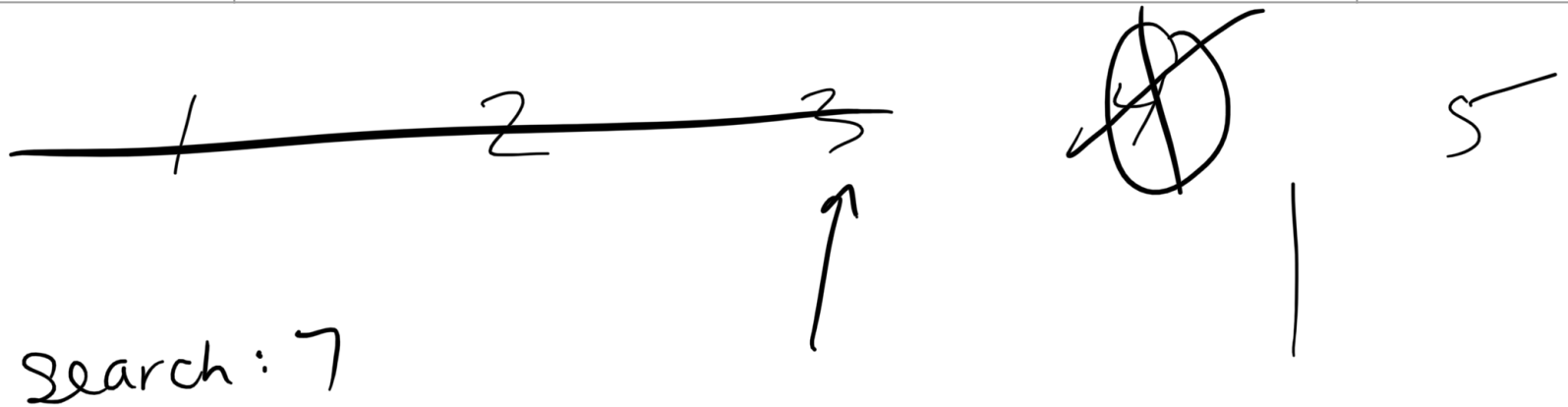

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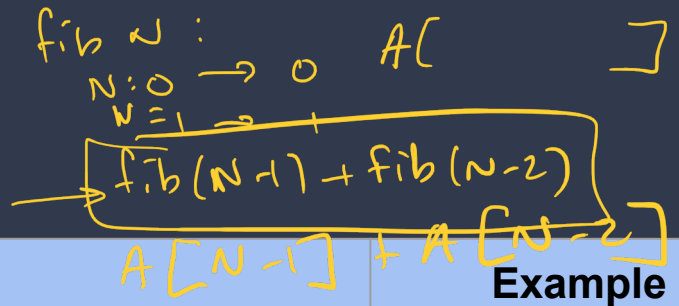

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greedy	builds a global solution to a problem by repeatedly making the best possible local choice	Dijkstra's Algorithm