I) How to prepare

- try and solve problems on your own
- code on paper?
- test your code on paper
- type your code as is to track mistakes

II) What do you need to know

- Core Data Structures, Algorithms and Concepts

DATA STRUCTURES

- linked lists
- trees, tries & graphs
- stacks and queues
- Heaps
- vectors / array lists
- hash tables

ALGORITHMS

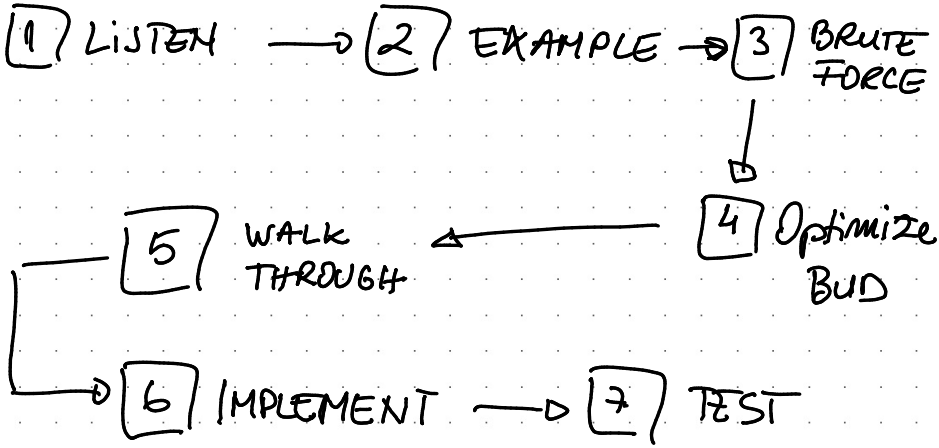
- Breadth-First search
- Depth-First search
- Binary search
- Merge sort
- Quick sort

CONCEPTS

- Bit Manipulation
- Memory (stack vs. Heap)
- Recursion
- Big O time & Space
- Dynamic Programming

* Hash tables are very important
* Powers of 2 Table

Walking Through a Problem



BUD = Bottlenecks, Unnecessary work, Duplicated work

* draw an example on the board
* look at unused information
* make time vs. space tradeoff
* precompute information
* hash tables
* write beautiful code (modularized)

IV) Optimize: Look for BNO

- Bottlenecks - slows down overall runtime
- Unnecessary work

$a^3+b^3 = c^3+d^3$ $\quad 1 < a,b,c,d < 1000$

---

n = 1000
for a from 1 to n
  for b from 1 to n
    for c from 1 to n
      for d from 1 to n
        if $a^3+b^3 = c^3+d^3$
          print a, b, c, d
          break out of the d loop

$O(N^4)$

---

for a
  for b
    for c
      $d = \sqrt[3]{a^3+b^3-c^3}$
      if (cond)
        print

$O(N^3)$

```
n = 1000
for c from 1 to n
    for d ...
        result = c^3 + d^3
        append (c, d) to list ( map [result])
```

```
for a ...
    for b ...
        result = a^3 + b^3
        list = map.get(result)
        foreach pair in list
            print a, b, pair
```

```
for each result, list in map
    for each pair 1 in list
        for each pair 2 in list
            print pair 1, pair 2
```

$O(N^2)$

V) Optimize: Diy