DSA Roadmap

Data Structures

Essential (mostly)

- Array
  - C-style array (original array)
  - Java style array (dynamically allocated array)
  - Python style array (dynamically allocated and dynamically sized array)
  - Implementing Python style array using malloc
  - nd-array
- Linked List
  - Singly Linked List
  - Doubly Linked List
  - Cyclic Linked List
  - Implementing Linked List using Array
- Stack
  - Array based implementation
  - Linked List based implementation
  - Converting all recursion to while loops
  - Monotonic stack
- Queue
  - Array based implementation
  - Linked List based implementation
  - Make a Queue with 2 stacks & 1 stack
  - Make a stack with 2 queues
  - Monotonic queue
- Deque
  - Array based implementations
    - Always growing implementation
    - Ring Buffer implementation
  - Linked List based implementations
    - Singly Linked List based implementation
    - Doubly Linked List based implementation
    - Cyclic Linked List based implementation
  - Monotonic deque
- Binary Tree
  - Binary Search Tree (BST)
  - Greater Sum Tree (GST)
- Binary Heap (usage only)
- Set
  - Hash Set
  - Tree Set
- Map/Dictionary
- n-ary Tree
  - Trie (26-ary tree)
    - Trie Map (introduction only)
- Graph
  - Graph as recursive data structure
  - Graph as an edges list
  - Graph as an adjacency matrix/list
  - DAG, UAG, DCG, UCG, MST, etc
- Disjoint Set

Non essential

- Binary Heap (implementation)
  - Array based implementation
  - Tree based implementation

- Fibonacci Heap
- Red-Black Tree
- Segment Tree
  - 1d segment tree
  - 2d segment tree
- Fenwick Tree
- B Tree
- B+ Tree

Algorithms

Fundamentals

- Big Oh notation
  - O notation
  - θ-notation
  - Ω-notation
  - implication of notation
  - amortization
- Search
  - Linear Search
  - Binary Search
- Sorting
  - Bubble sort
  - Insertion sort
  - Selection sort
  - Merge sort
  - Quick sort
  - Counting sort
  - Radix Sorting
    - LSD Radix sort
    - MSD Radix sort
  - Tim sort
  - Stable vs unstable sort
- Tree traversal algorithms
  - Pre order
    - Recursive
    - while loop with stack
    - Morris
  - Post order
    - Recursive
    - while loop with a stack
    - Morris
  - In order
    - Recursive
    - While loop with a stack
    - Morris
  - Level order
    - Recursive
    - While loop with a stack
    - While loop with a queue
    - Morris
  - Euler Tour of Tree
- Floyd's tortoise and hare
- Graph path finding
  - DFS
  - BFS
  - GBFS
  - A*

    - Dijkstra's algorithm
    - Bellman Ford
- Flood fill algorithm
- Graph coloring algorithm
- Union Find
- Minimum Spanning Tree finding algorithms
    - Prim's algorithm
    - Kruskal's algorithm

Advanced Algorithmic Concepts & Techniques

- Two pointer
- Sliding window
- Bit Manipulation
- Greedy Algorithms
- Prefix sum
- Memoization and caching
    - Top Down
    - Bottom Up
- Dynamic programming
    - Top Down
    - Bottom Up
- Math