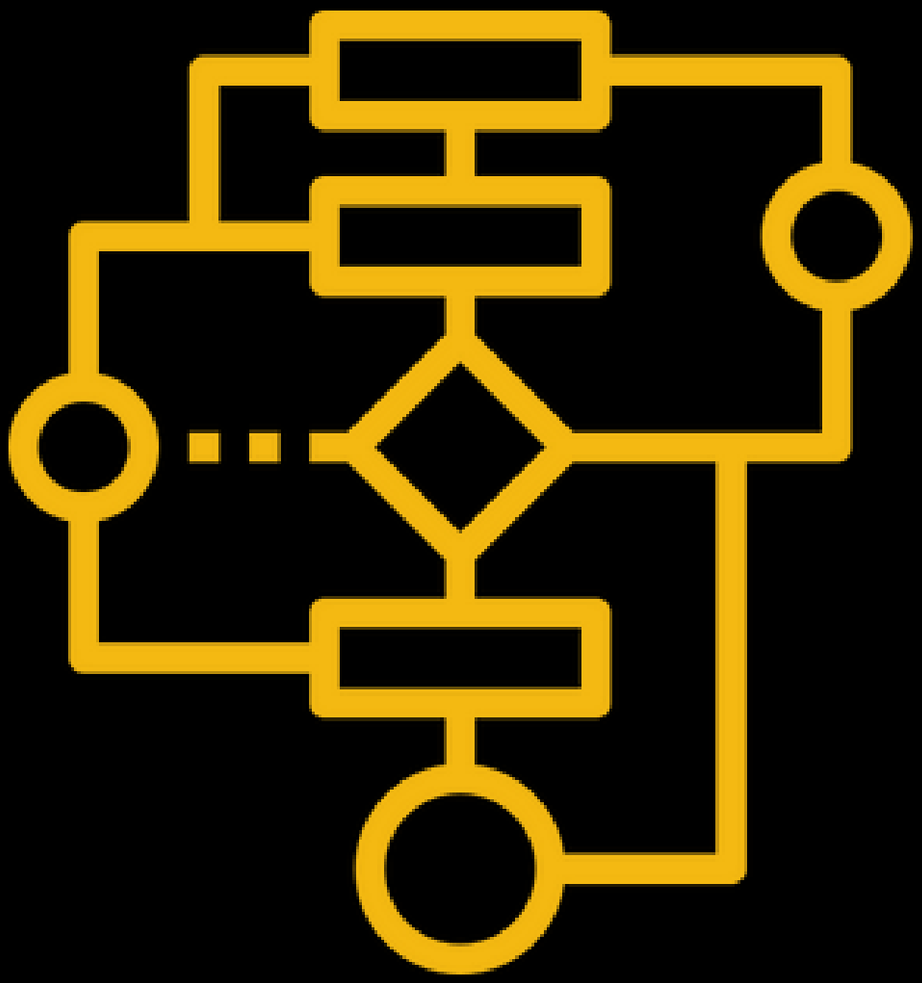

DSA Roadmap

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Basic Concepts in Computer Science

- Basics of a programming language (e.g., Java, C++, Python)
- Understanding of how computers work, memory management, etc.
- Basics of mathematical reasoning and proofs (especially if you aim for a deep understanding).

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Introduction to Data Structures

- Linear Data Structures
  - Arrays
  - Linked Lists (Singly and Doubly)
  - Stacks
  - Queues (and variations like Deque)
- Non-Linear Data Structures
  - Trees
    - Binary Trees
    - Binary Search Trees
    - AVL Trees, Red-Black Trees (Balanced Trees)

- ## Non-Linear Data Structures
  - Graphs
    - Representations: adjacency matrix, adjacency list
    - Breadth-first search (BFS), Depth-first search (DFS)

- ## Advanced Data Structures
  - Heaps and Priority Queues
  - Hash Tables and Hash Maps
  - Disjoint Set/Union-Find
  - Trie, Suffix Tree, and Suffix Array

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Introduction to Algorithms

- Algorithm Analysis
  - Time and Space Complexity (Big O, Big Omega, Big Theta notation)
  - Best case, average case, and worst-case scenarios
- Basic Algorithms
  - Sorting: Bubble, Selection, Insertion, Merge, Quick, Radix, Heap sort.
  - Searching: Linear Search, Binary Search

Introduction to Algorithms

- Divide and Conquer
- Greedy Algorithms
- Dynamic Programming
- Backtracking

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Graph Algorithms

- Shortest Path (Dijkstra, Bellman-Ford, Floyd-Warshall)
- Minimum Spanning Tree (Kruskal's, Prim's)
- Topological Sort
- Network Flow algorithms

Advanced Topics

- String matching and pattern searching algorithms (like the Knuth-Morris-Pratt algorithm)
- Geometric algorithms
- NP-Completeness and Computational Intractability
- Approximation algorithms

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Practice

- Implement DS&A you learn to internalize the concepts.
- Solve problems on platforms like LeetCode, HackerRank, Codeforces, or GeeksforGeeks.
- Join coding competitions for a fun challenge.

Remember, the journey of mastering DSA is not a sprint; it's a marathon.

Stay persistent, and happy coding!

Ali Samir

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Software Engineer

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