**Certainly! Here’s a concise list of essential data structure topics:**

1. **Array**
2. **String**
3. **LinkedList**
4. **Stack and Queue**
5. **Tree**
6. **Binary Search Tree (BST)**
7. **Graph**
8. **Trie**
9. **Heap**
10. **Hashing**
11. **Recursion, Backtracking, and Dynamic Programming**
12. **Greedy Algorithms**
13. **Sorting and Searching**
14. **Pattern Searching**
15. **Divide and Conquer Algorithms**
16. **Number Theory**
17. **Bit Manipulation**

**# Basic Data Structures**

1. **Arrays**
   * Static and Dynamic Arrays
   * Multidimensional Arrays
2. **Linked Lists**
   * Singly Linked List
   * Doubly Linked List
   * Circular Linked List
3. **Stacks**
   * Implementation using Arrays and Linked Lists
   * Applications of Stacks (e.g., expression evaluation, backtracking)
4. **Queues**
   * Simple Queue
   * Circular Queue
   * Priority Queue
   * Deque (Double-ended Queue)

**Trees**

**5 Binary Trees**

* + Properties and Types (Complete, Full, Perfect)
  + Traversal Methods (Preorder, Inorder, Postorder, Level Order)

**6 Binary Search Trees (BST)**

* + Insertion, Deletion, Search operations
  + Self-Balancing Trees (e.g., AVL Tree, Red-Black Tree)

**7 Heaps**

* + Min-Heap, Max-Heap
  + Heap Operations and Applications (e.g., Heap Sort, Priority Queue)

1. **Trie (Prefix Tree)**

Construction, Search, Deletion

Applications (e.g., Autocomplete, Spell Checker)

1. **Segment Tree**
   1. Range Query, Point Update
   2. Lazy Propagation
2. **Fenwick Tree (Binary Indexed Tree)**
   1. Point Update, Range Query
   2. Applications

**11. Graphs**

* **Representation**
  + Adjacency Matrix
  + Adjacency List
  + Edge List
* **Graph Traversal**
  + Depth-First Search (DFS)
  + Breadth-First Search (BFS)
* **Shortest Path Algorithms**
  + Dijkstra's Algorithm
  + Bellman-Ford Algorithm
  + Floyd-Warshall Algorithm
  + A\* Search Algorithm
* **Minimum Spanning Tree (MST)**
  + Kruskal's Algorithm
  + Prim's Algorithm
* **Advanced Graph Algorithms**
  + Topological Sorting
  + Strongly Connected Components (Tarjan's Algorithm)
  + Network Flow (Ford-Fulkerson Algorithm, Edmonds-Karp Algorithm)
  + Bipartite Graph Checking

**4. Hashing**

* **Hash Tables**
  + Open Addressing (Linear Probing, Quadratic Probing)
  + Separate Chaining
* **Hash Functions**
  + Properties and Design
  + Collision Resolution Techniques

**# Advanced Data Structures**

* **Skip List**
  + Insertion, Deletion, Search
  + Applications
* **B-Trees and B+ Trees**
  + Properties and Operations
  + Usage in Databases
* **Splay Trees**
  + Splaying, Insertion, Deletion
* **Treap**
  + Priority and BST Property
  + Operations and Applications
* **Suffix Tree and Suffix Array**
  + Construction
  + Applications in String Matching
* **Disjoint Set (Union-Find)**
  + Union by Rank, Path Compression
  + Applications in Kruskal’s Algorithm

**6. Specialized Data Structures**

* **Bloom Filter**
  + Probabilistic Data Structure
  + False Positive Rate
* **Quad Trees and Octrees**
  + Spatial Partitioning
  + Applications in Graphics and Game Development
* **K-D Trees**
  + Multidimensional Search
  + Nearest Neighbor Search
* **R-trees**
  + Spatial Indexing
  + Applications in Geographic Information Systems (GIS)

**7. String Data Structures**

* **Rabin-Karp Algorithm**
  + Rolling Hash Technique
* **Knuth-Morris-Pratt (KMP) Algorithm**
  + Prefix Function
* **Boyer-Moore Algorithm**
  + Good Suffix, Bad Character Heuristics

**8. Concurrency Data Structures**

* **Concurrent Linked Lists**
  + Lock-based and Lock-free Implementations
* **Concurrent Queues**
  + Blocking and Non-blocking Queues
* **Skip List**
  + Concurrent Variants

Sorting Algorithms

Comparison-Based Sorting

Simple Sorts

Bubble Sort

Selection Sort

Insertion Sort

Efficient Sorts

Merge Sort

Quick Sort

Heap Sort

Hybrid Sorts

Timsort

IntroSort

Non-Comparison-Based Sorting

Counting Sort

Radix Sort

Bucket Sort

Specialized Sorts

Shell Sort

Pigeonhole Sort

Searching Algorithms

Linear Search

Simple Linear Search

Binary Search

Classic Binary Search

Binary Search Variants

Hash-Based Search

Direct Addressing

Hash Tables

Tree-Based Search

Binary Search Tree (BST)

AVL Tree

Red-Black Tree

☐ B-Trees and B+ Trees

Graph-Based Search

Depth-First Search (DFS)

☐ Breadth-First Search (BFS)

Sorting and Searching Algorithms

String Search Algorithms

☐ Naive String Search

☐ Knuth-Morris-Pratt (KMP) Algorithm

☐ Rabin-Karp Algorithm

☐ Boyer-Moore Algorithm

Advanced Search Techniques

Exponential Search

☐ Interpolation Search

☐ Fibonacci Search

☐ Jump Search