

# Data Structures Summary

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## 1. What is a Data Structure?

A data structure is a special way to organize and store data in a computer so that it can be used efficiently.

There are two main types of data structures:

- - Linear Data Structures (like Arrays, Linked Lists, Stacks, Queues)
- - Non-Linear Data Structures (like Trees and Graphs)

## 2. Data Structures Mind Map

Imagine a tree structure starting from 'Data Structures', branching into 'Linear' and 'Non-Linear', then further branching into their types.

## 3. Overview of Each Data Structure

### Arrays

An array is a collection of items stored at continuous memory locations.

### Linked Lists

A linked list is a linear data structure where each element is a separate object called a node. Each node has data and a pointer to the next node.

### Stacks

A stack is a linear data structure that follows the Last In First Out (LIFO) principle. You can only add or remove from the top.

### Queues

A queue is a linear data structure that follows the First In First Out (FIFO) principle. You insert from the rear and remove from the front.

### Trees

Trees are non-linear data structures with a hierarchical relationship among elements.

### Graphs

Graphs consist of a finite set of vertices (nodes) and edges connecting them.

## 4. What is a Linked List?

A linked list is made up of nodes where each node contains data and a reference (link) to the next node in the sequence.

Types of Linked Lists:

- - Singly Linked List
- - Doubly Linked List
- - Circular Linked List

Applications:

- - Implementing stacks and queues
- - Efficient memory utilization
- - Real-time computing where data must be added/removed frequently

## 5. Stack vs Queue

Stack: Follows LIFO (Last In First Out). You can only access the top element.

Queue: Follows FIFO (First In First Out). You access from front and add to the rear.

Comparison:

- Stack:
  - - Add/Remove from one end (top)
  - - Used in function call management, expression evaluation
- Queue:
  - - Add at rear, remove from front
  - - Used in scheduling, print queues, buffer handling