Basic Terminologies of Data Structures

Author : AI Generated **Date :** 2025-01-30

Introduction

Basic Terminologies: Data structure is a specialized format for organizing, processing, retrieving, and storing data. Common types include arrays, linked lists, stacks, queues, trees, and graphs.

Asymptotic Notations: These notations describe the complexity of an algorithm.
- **Big O (O)**: Upper bound on running time.
- **Theta (Θ)**: Tight bound.
- **Omega (Ω)**: Lower bound.

Array and its Operations: An array is a collection of elements stored at contiguous memory locations. Operations include insertion, deletion, traversal, searching, and sorting.

Searching Techniques:
- **Linear Search**: Sequentially checks each element.
- **Binary Search**: Uses divide and conquer, works on sorted arrays.

Sorting Techniques:
- **Bubble Sort**: Repeatedly swaps adjacent elements if they are in the wrong order.
- **Selection Sort**: Selects the smallest element and swaps it to its correct position.
- **Insertion Sort**: Builds a sorted sequence one element at a time.
- **Heap Sort**: Uses a binary heap to sort elements.
- **Shell Sort**: A generalized version of insertion sort with gaps.

Performance Comparison: Sorting algorithms vary in time complexity. Bubble, Selection, and Insertion Sort have $O(n^2)$ complexity, whereas Heap and Shell Sort have improved performance in some cases.