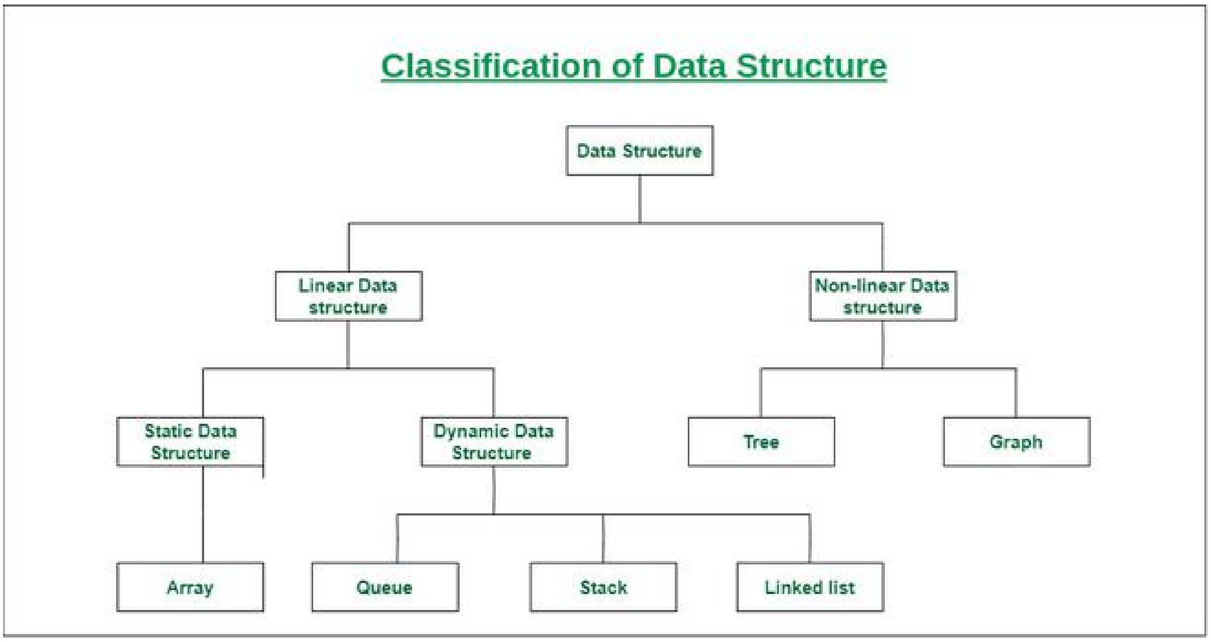
Introduction to Data Structures

Definition of Data Structures

- ❖ Data structures are fundamental concepts in computer science that involve the
  - Organization
  - Storage
  - Manipulation of data
- ❖ They provide a systematic way to store and manage information, making it accessible and efficient to work with.
- ❖ Data structures are the building blocks of algorithms and play a crucial role in software development.



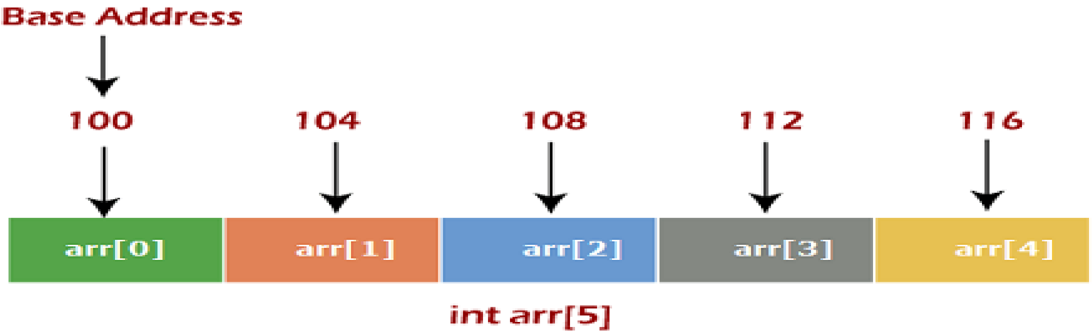
Types of Data Structures

1) Linear Data Structures
2) Non-linear Data Structures

Linear Data Structures

- Linear data structures are arrangements of data elements where each element has a unique predecessor and successor, forming a sequential order.
- The following data structures are referred to as linear data structures:

a) Array: A linear collection of elements with indexed access for efficient retrieval.



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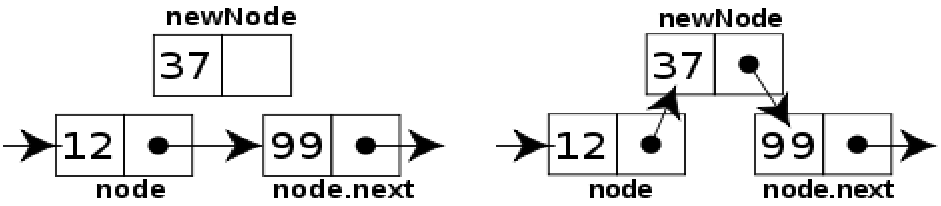
b) Linked List: Elements connected by pointers, allowing dynamic allocation and efficient insertions/deletions.



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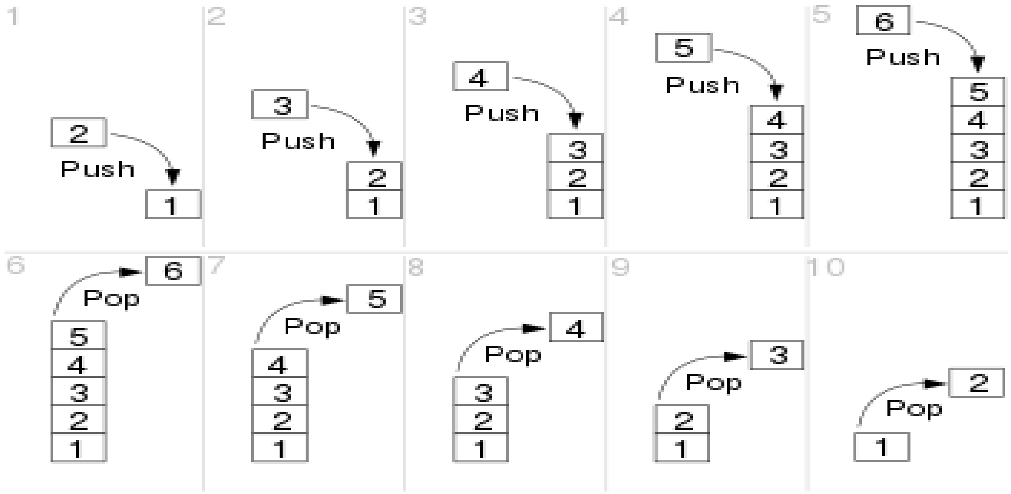
c) Stack: Follows the Last-In-First-Out (LIFO) principle with top-based element manipulation.



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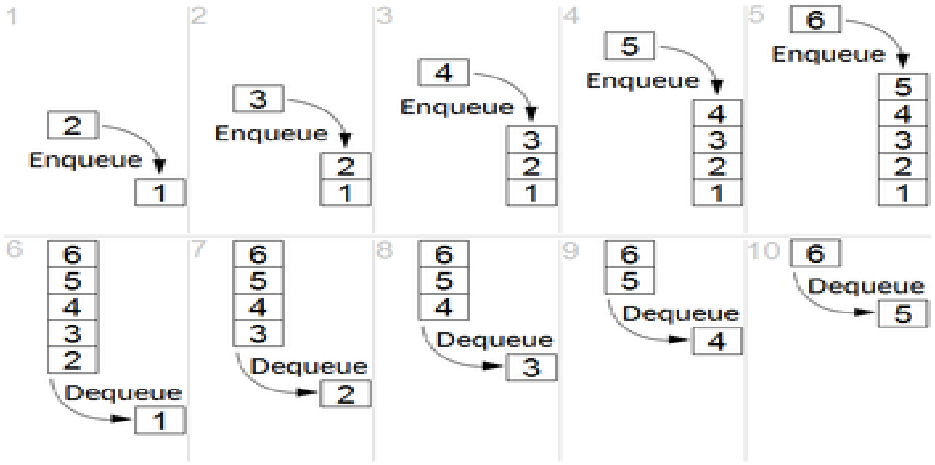
d) Queue: Adheres to the First-In-First-Out (FIFO) concept, used for ordered processing.



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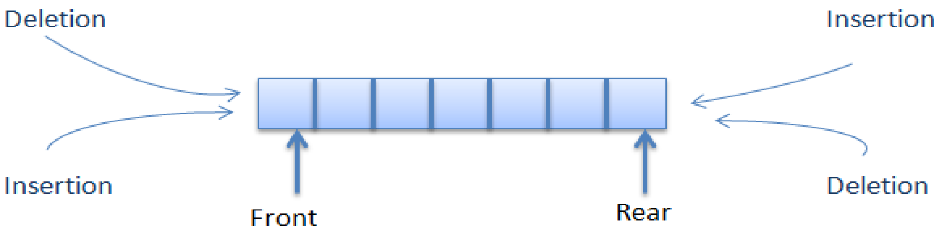
e) Deque: Supports insertion and removal at both ends, offering enhanced flexibility.



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The Need for Linear Data Structures

- Ordered Storage: Linear data structures maintain a sequential order, which is essential for scenarios where data must be processed sequentially or accessed in a specific arrangement.
- Efficient Access: Direct indexing or traversal capabilities of linear structures allow for quick and convenient access to elements.
- Insertion and Deletion: Linear structures provide efficient methods for adding and removing elements, which is crucial for dynamic data manipulation.
- Memory Optimization: Linear structures allocate memory contiguously, optimizing memory usage and access efficiency.