DATA STRUCTURES AND ITS APPLICATIONS

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Introduction to Data Structures

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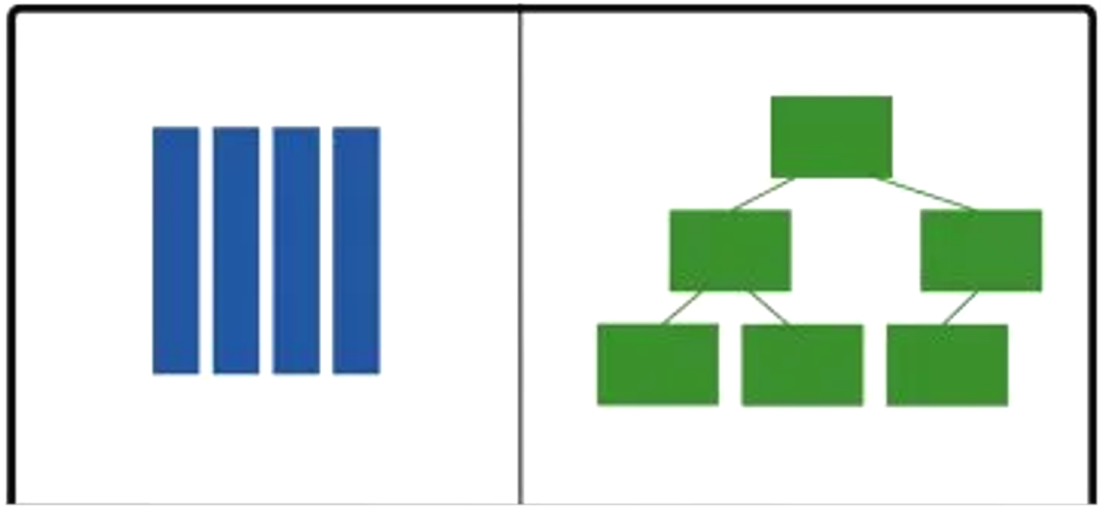
Introduction to Data Structures

Data Structure is a scheme of organizing data in the memory of the computer in such a way that various operations can be performed efficiently on this data



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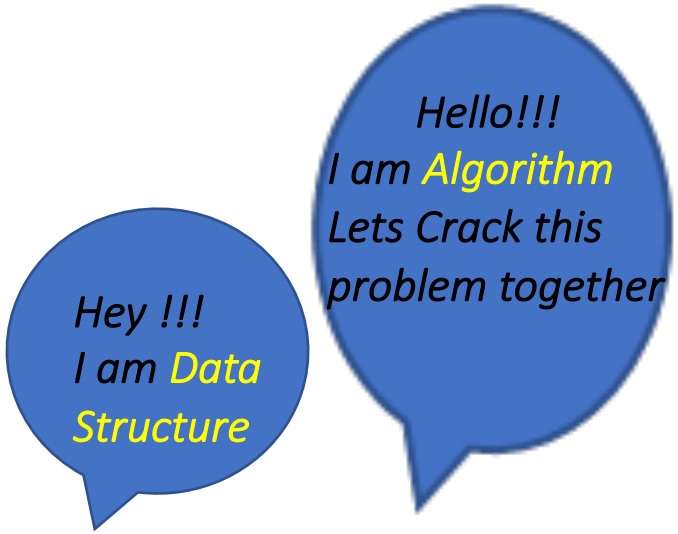
Why Data Structure?

Why Data Structures?

- Computer systems deal with large amount of data (text ,image, relational data etc.)
- Data is just the raw material for information, analytics, business intelligence, advertising, etc.
- The way data is organized in memory plays a key role in deciding the time complexity of the algorithms designed for solving the problems
- Data Structures and algorithm go hand in hand



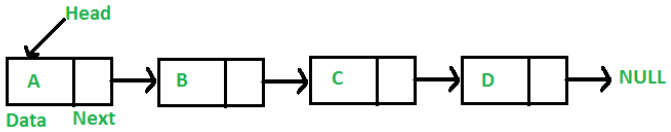
Importance of Data Structures

- Data Structures is most fundamental and building block concept in computer science

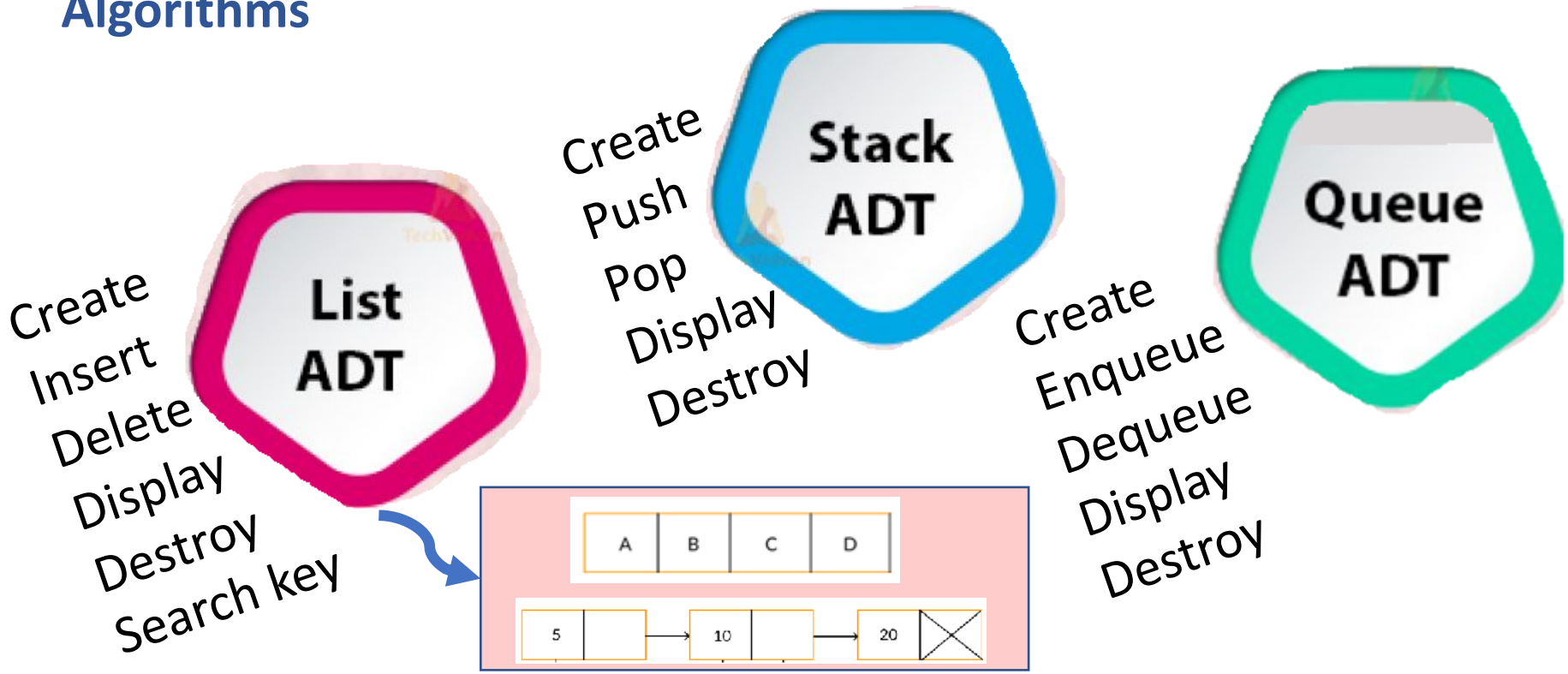
- Good knowledge of Data Structures is required to build efficient software systems

Data Structures and its Applications

Abstract Data Type



- Abstract Data Type is used to represent data and operations associated with an entity from the point of view of user irrespective of implementation
- ADT can be implemented using one or more **Data Structures** and **Algorithms**



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Classification of Data Structures

- **Linear Data Structures**

  Stack, Queue, Linked List

- **Non Linear Data Structures**

  Tree , Graph

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Classification of Data Structures : Linear Data Structures

Linear Organisation

Stack
Queue
Linked List
Linear List using Array

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Classification of Data Structures : Non Linear Data Structures

Non Linear Organisation

Tree

Graph

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Few Applications of Linear Data Structures

- **Array**
  - To implement other data structures
  - To store files in memory

- **Linked Lists**
  - To implement other data structures
  - To manipulate large numbers

- **Stacks**
  - Recursion
  - Infix to postfix conversion

- **Queues**
  - Process Scheduling
  - Event handling

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Few Applications of Non Linear Data Structures

- **Tree**
  - Auto complete features (Trie)
  - Used by operating systems to maintain the structure of a file system
- **Heaps**
  - Priority Queue implementation
  - Heap Sort
- **Graphs**
  - Computer Networks
  - Shortest Path Problems

Data Structures and Applications

Overview- Course Contents

Unit -1 : Linked Lists

- Memory Allocation Static and Dynamic
- Singly Linked List
- Doubly Linked Lists
- Circularly Linked Lists
- Multi Lists : Sparse Matrix
- Applications :
  - Text Editor
  - Symbol Table of an Assembler

Data Structures and Applications

Overview- Course Contents

Unit -2 : Stacks

- Basic Structure of Stack
- Array and Linked Implementation
- Applications :
  - Recursion
  - Conversion of Infix to Postfix
  - Conversion of Infix to Prefix
  - Evaluation of Expression
  - Parentheses Matching

Data Structures and its Applications

Overview

Unit -2 : Queues

- Basic Structure
- Circular Queue, Priority Queue, Dequeue
- Array and Linked Implementation
- Applications :
  - Josephus Problem,
  - CPU Scheduling

Data Structures and Applications

Overview- Course Contents

Unit -3 : Trees

- Definitions, Binary Trees, Binary Search Tree, Threaded Binary trees.
- Operations on Trees
- Implementation of BST,
- Threaded BST

Unit -3 : Heaps

- Heap as a Data Structure
- Array Implementation
- Priority queue as a heap
- Applications : Dictionary Implementation, Simulation of Airport operations.

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Overview- Course Contents

Unit -4 : Balanced Trees and Graphs

- AVL Trees
- Operations on AVL Trees
- Properties of Graphs
- Implementation of Graphs
- Search Operations on Graph
- Applications :
  - Indexing in data bases
  - Representing a Computer Topology

Data Structures and its Applications

Overview- Course Contents

Unit -5 : Suffix Trees

- Tries
- Implementation of Tries
- Operations on Tries : Insert, delete and search
- Applications :
  - Word Prediction
  - URLs Decoding
  - Cryptography

Unit -5 : Hashing

- Hashing Techniques
- Collision resolution
- Double Hashing, Rehashing

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Overview- Course Contents

Text Book :

Data Structures using C & C++

Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, 2015, Pearson Education, 2nd Edition.

Reference Book:

Data Structure and Program Design in C

Robert Kruse, C.L Tondo, Bruce P. Leung – 2007, Pearson Education, 2nd Edition.

THANK YOU

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