Swipe >>>

Data Structure

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DATA STRUCTURE #1 Array

An array is a collection of similar types of items stored at contiguous memory locations.

Applications:

1. Used for performing matrix operations.
2. Used for CPU scheduling.
3. Used to implement other data structures like Stacks, Queues, Heaps, Hash tables etc.

Advantages:

1. Stores multiple items under same name.
2. Random Access is possible.

Disadvantages:

1. Number of elements to be stored is to be known in advance.
2. Insertion and deletion is difficult.

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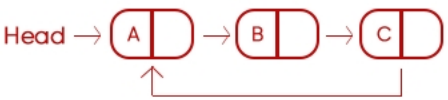
DATA STRUCTURE #2 Linked List

Linked list consists of nodes where each node contains a data field and a reference (link) to the next node in the list.

Singly Linked List

Doubly Linked List



Circular Linked List

Advantages:

1. Insertion and deletion of nodes are easier.
2. It is dynamic in nature.

Disadvantages:

1. More memory required store elements.
2. Nodes traversal is difficult.

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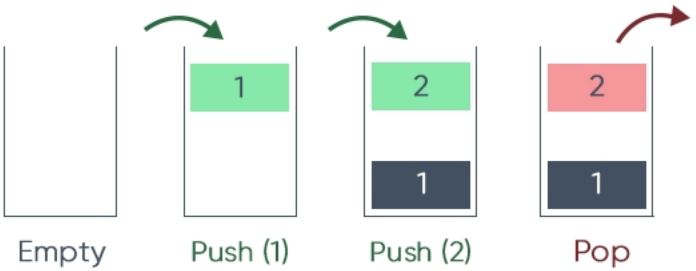
DATA STRUCTURE #3 Stack

Stack is a linear data structure which follows LIFO (Last In First Out) principle.



Applications:

1. Prefix and postfix expression evaluation.
2. Memory Management.
3. Backtracking problems.

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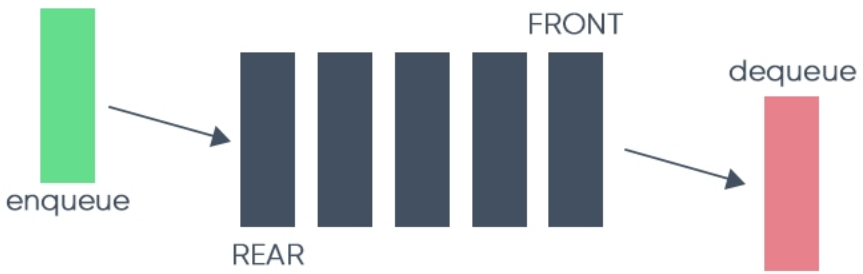
DATA STRUCTURE #4 Queue

Queue is a linear data structure which follows FIFO (First In First Out) principle.



Applications:

1. CPU task scheduling.
2. Handling of interrupts in real-time systems.
3. In real life scenario, Call Center phone systems.

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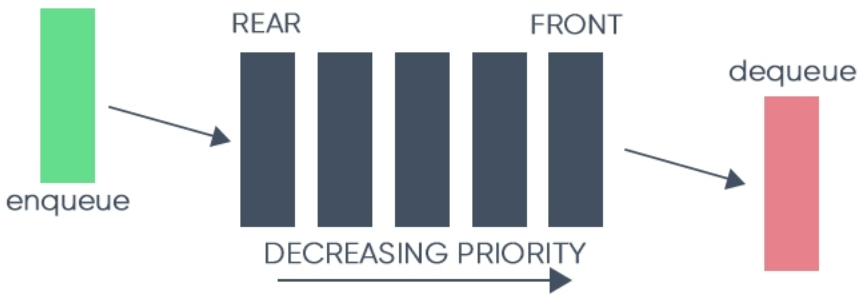
DATA STRUCTURE #5 Priority Queue

Priority Queue is an extension of queue where every item has a priority associated with it.



Applications:

1. Dijkstra's Shortest Path Algorithm.
2. Prim's Algorithm to store keys of nodes.
3. Huffman codes which is used to compresses data.

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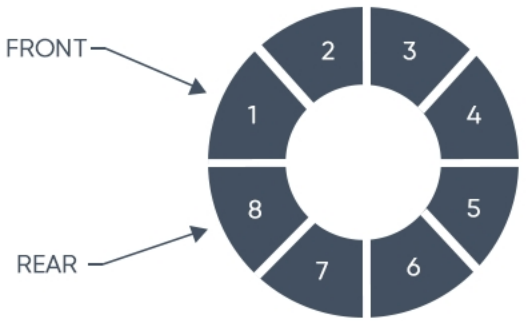
DATA STRUCTURE #6 Circular Queue

Circular Queue is an extension of queue where the rear is connected to the front.



Applications:

1. System Memory Management.
2. CPU Process Scheduling.
3. Also used in Traffic Systems.

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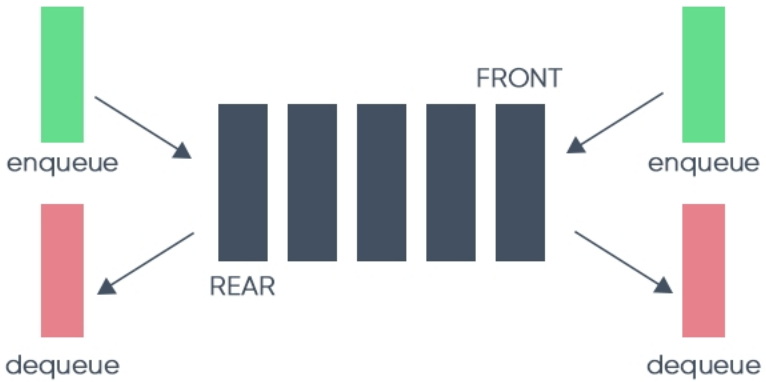
DATA STRUCTURE #7 Deque

Deque is an extension of queue where elements can be added from the rear as well as from the front.



Applications:

1. Supports clockwise and anticlockwise rotations in O(1) time.
2. In undo operations on software.
3. To store history in browsers.

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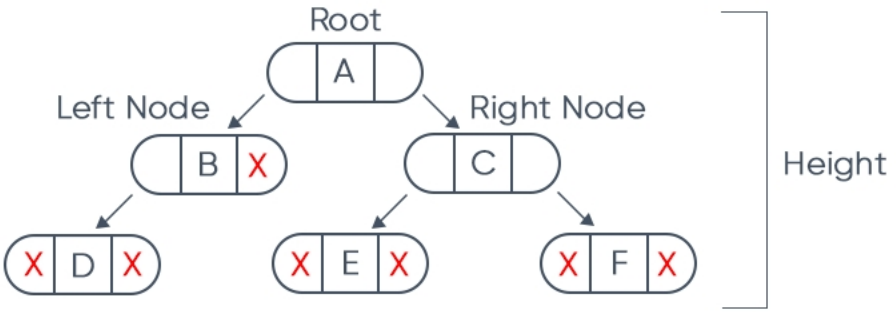
DATA STRUCTURE #8 Binary Tree

A binary tree is a tree-type non-linear data structure with a maximum of two children for each parent.



Applications:

1. For easy and quick access to data.
2. To implement BST and heap data structure.
3. In router algorithms.
4. Syntax tree.

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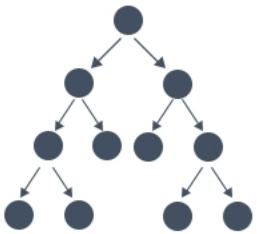
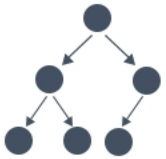
DATA STRUCTURE #9 Types of binary tree

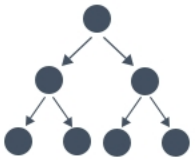


Full

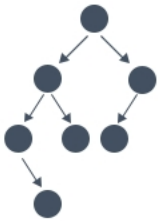


Complete

Degenerate



Perfect



Balanced

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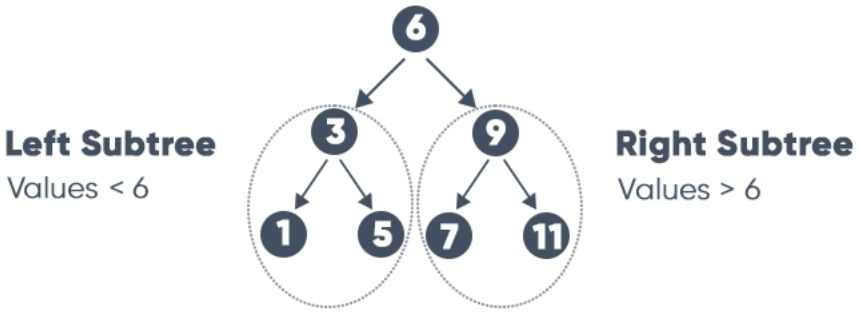
DATA STRUCTURE #10 Binary Search Tree

Binary Search Tree (BST) is a rooted binary tree where :-

1. All nodes of left subtree are less than the root node
2. All nodes of right subtree are more than the root node



Applications:

1. Indexing and multi-level indexing.
2. Implement various searching algorithms.
3. Implementing TreeMap and TreeSet data structures.

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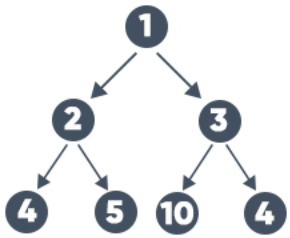
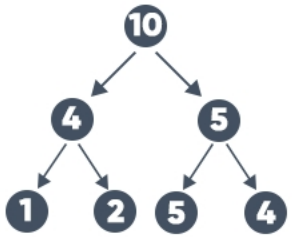
DATA STRUCTURE #11 Heap

A Heap is a special Tree-based data structure which satisfies -

1. **Max Heap** :- Root node key must be the greatest
2. **Min Heap** :- Root node key must be the least



Min Heap



Max Heap

Applications:

1. Implementation of Priority Queues.
2. Find the kth smallest (or largest) element in an array.
3. Implementation of Heap Sort.

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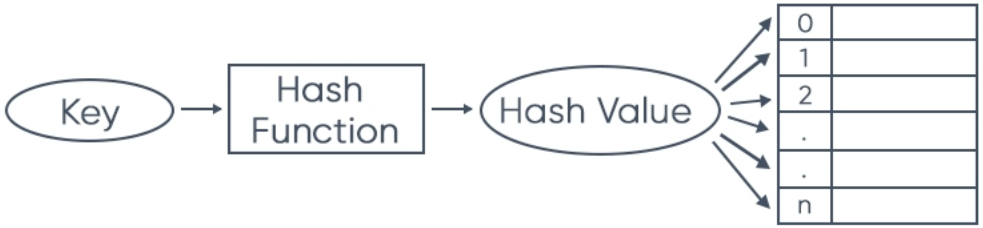
DATA STRUCTURE #12 Hashing

Hashing is a technique or process of mapping keys, values into the hash table by using a hash function.



Hashing Mechanism

Applications:

1. Message Digest using cryptographic Hash Functions.
2. Password Verification using cryptographic Hash Functions.
3. To differentiate between keywords and other identifiers by compiler.

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DATA STRUCTURE #13 Types of Hash Functions

A hash function is any function that can be used to map data of arbitrary size to fixed-size values.

Charateristics of good Hash Function

1. Easy to compute
2. Uniform Distribution
3. Less collisions

Division Method

$h(k) = k \bmod n$

Multiplication Method

$h(k) = \text{floor}(n (kA \bmod 1))$

h(k) - The hash value
k - Key value
n - Size of hash table n
A - Can be any constant value between 0 and 1

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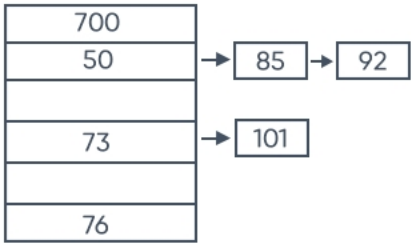
DATA STRUCTURE #14 Hash Collision

Collision is a situation that occurs when two distinct pieces of data have the same hash value.

Collision is handled using following collision handling techniques -

1. Separate Chain

The idea is to make each cell of hash table point to a linked list.



2. Open Addressing

All elements are stored in the hash table itself.

a. Double Hashing

b. Linear Probing

c. Quadratic Probing

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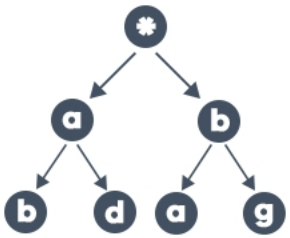
DATA STRUCTURE #15 Tries

Tries are a type of search tree used to represent the "Retrieval" of data and thus the name Trie.



* = Null

ab
ad
ba
bg

Strings

Applications:

1. Search Engine results optimization.
2. Easy insertion, deletion and updation.
3. Easy operations for string handling.

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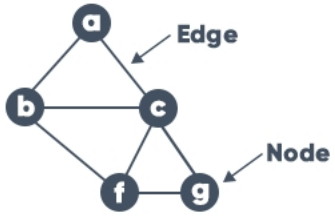
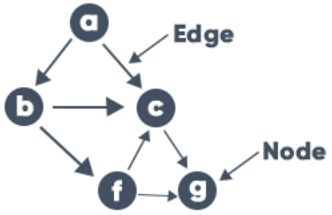
DATA STRUCTURE #16 Graphs

A Graph is a non-linear data structure consisting of nodes and edges. Nodes are the vertices and edges are the lines.



Undireted Graph



Directed Graph

Types of Graph Representations:

1. Adjacency List : An array of lists is used. The size of the array equals to the number of nodes.
2. Adjacency Matrix : A 2D array of size V x V is used. V is the number of nodes in a graph.

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