What is Data structure?

→ Data can be arranged in a many ways, logical or mathematical arrangement of a data is called Data structure.

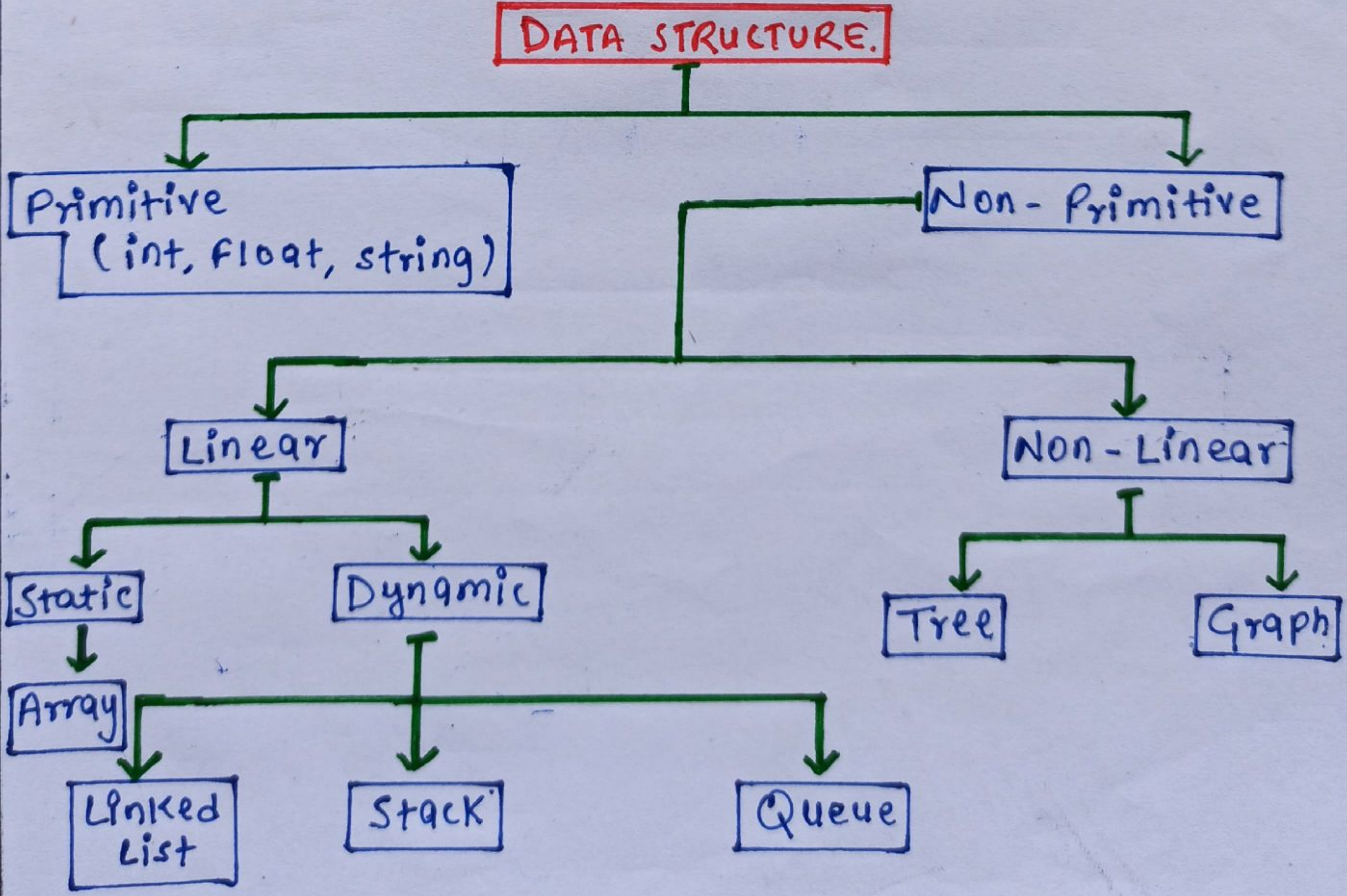
Examples: Array, linkedlist, stack, Queue, Tree Graph and many more.

What is an Algorithms?

→ Sequence of steps performed on the data using efficient data structures to solve a given problem.

Example: Sorting an Array.

CLASSIFICATION OF DATA STRUCTURE



Types of Data Structures

a Primitive and Non-Primitive Data structure.
b Static and Dynamic Data structure.
c Persistent and ephmeral Data Structure.

Non-Primitive further Divided into two Types.

i). Linear Data Structure.
ii). Non-Linear Data Structure.

Persistent further Divided into three types.

i). Partialy Persistent.
ii). Fully Persistent.
iii). Confluently Persistent.

Data Structure Operations:

The following four operations play a major role.

(1). **Traversing :** Accessing each record exactly once so that certain items in the record may be processed.

(2). **Searching :** Finding the location of the record with a given key value.

(3). **Inserting :** Adding a new record to the structure.

(4). **Deleting :** Removing a record from the structure.

(5). **Merging:** Combining the records in two different sorted files into a single sorted file.

(6). **Sorting :** Arranging the record in some logical order Example :- Alphabetically according to some NAME Key or in Numerical order according to some NUMBER Key.

Searching Algorithms :

- A search algorithms is a step-by-step procedure using to locate specific data among collection of data.

Types of search algorithms with the complexity

1). **Linear Search :**

A linear search or sequential search is a method for finding an element within a list. It is sequentially checks each element of the list until a match is found or the whole list has been searched.

$\boxed{C(n) = n/2}$ ← Complexity of linear Search.

2). **Binary Search :**

In Binary search approach the element is always searched in the middle of a portion of an array.

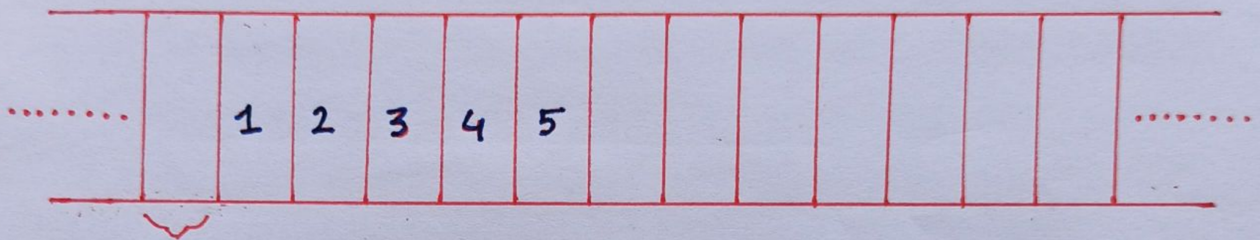
Binary search can be implemented only on a stored list of Items.

If the element are not sorted already, we need to sort them first.

$\boxed{c(n) = \log 2n}$ ← Complexity of Binary search.

ARRAY :

Array is a Type of linear Data structure OR Array is a collection of more than one data but all the data items are same data types, & stored that data in a compurer in a contigous memory location.



1 Bytes = 8 bit

Memory is a long tap of Bytes.

Types of Arrey :

① One Dimentional Array :

The array with only subscript that array is called as One Dimentional Array.

Example : int a[5]; ⟵ subscript.

② Two Dimentional Array :

The array with two subscript that array is called as Two Dimentional Array.

Example : int a[5][5]; ⟵ subscript.

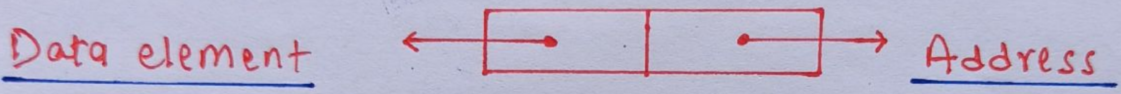
③ Multi-Dimentional Array :

The array with more than two subscript that array is called as Multi-Dimentional Array.

LINKED LIST :-

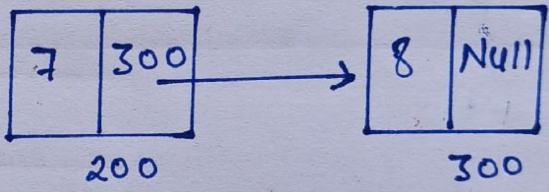
Linked list is a linear Data structure. it is also a collection of more than one data items of a disimilar data type like array but it can not stored it in contigues memory location. It can be stored randomly in a main memory.

so that linkedlist contains two part one for Data and second part for the Address of the next data element.

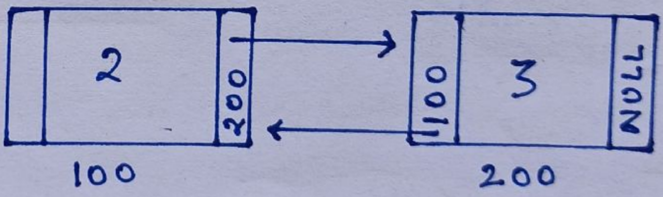


Types of linked list

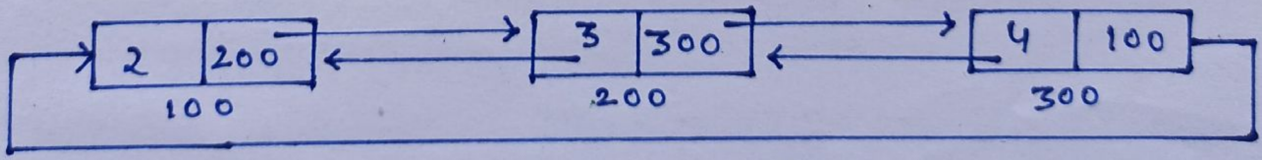
① Singly linked list :



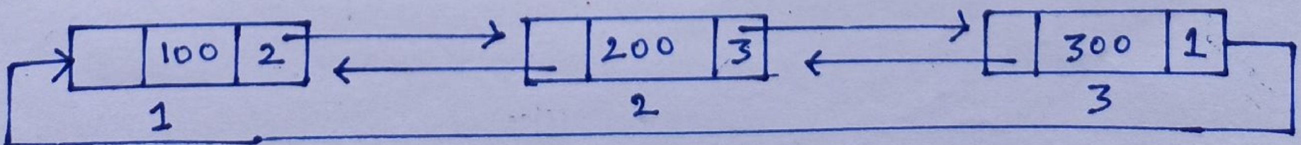
② Doubly linked list :



③ Circular linked list :

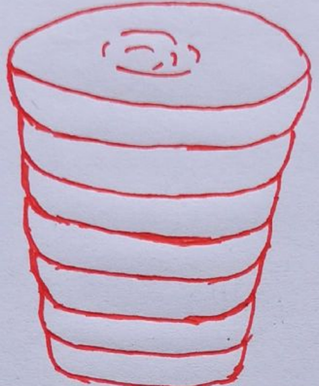


④ Doubly circular linked list :



STACKS

A stack is a list of elements in which an elements may be inserted or deleted only at one end called the TOP of the stack.



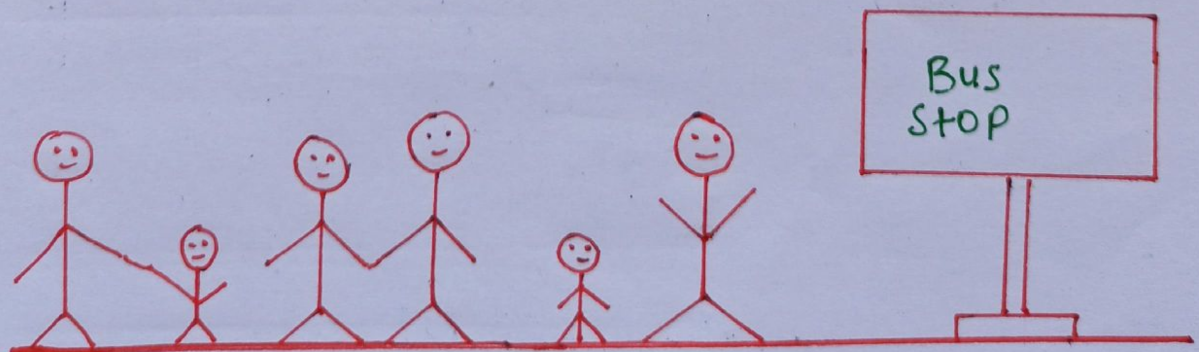
Stack of dishes

Push → Insert elements into stack

Delete elements from stack ← PoP.

QUEUES

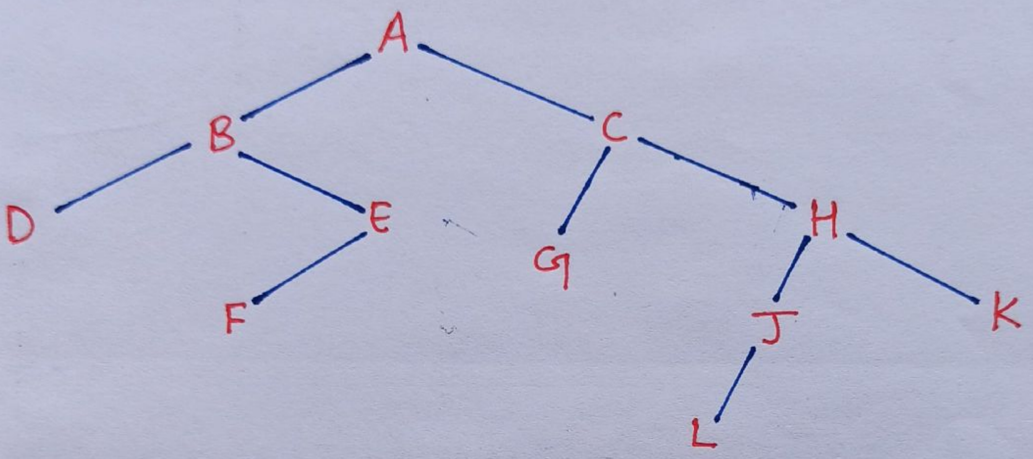
A Queue is a linear list of elements in which deletions can take place only at one end called front and insertions can take place only at the other end called the rear.



TREES

Trees are non-linear data structure where data are stored or data containing a hierarchical relationship b/w elements.

A binary tree T is defined as a finite set of elements called nodes.



Traversing Binary Trees

There are three ways of traversing a binary tree T with root R.

Preorder

1). Process the root R

2). Traverse the left subtree of R in Preorder

3). Traverse the Right subtree in preorder

Inorder

1). Traverse left substree

2). Process the root R

3). Traverse Right substree

Postorder

1). Traverse left substree.

2). Traverse Right substree.

3). Process the root R.

GRAPH

Graph is a collection of two set V and E where,

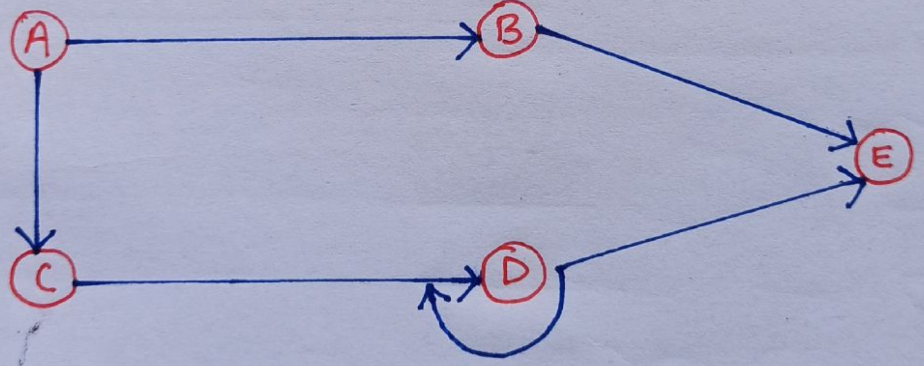
V → Vertices / Nodes

E → Edges

Graph is a mathematical structures that represent pair-wise relationship between objects where nodes are connected with edges.

Vertex → Vertex is nothing but the data element which is also known as Nodes

Edge → Edge is a connection link between two vertices



Representation of the graph

(A) Adjacency Matrix

(B) Adjacency List

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