What is Data structure?

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

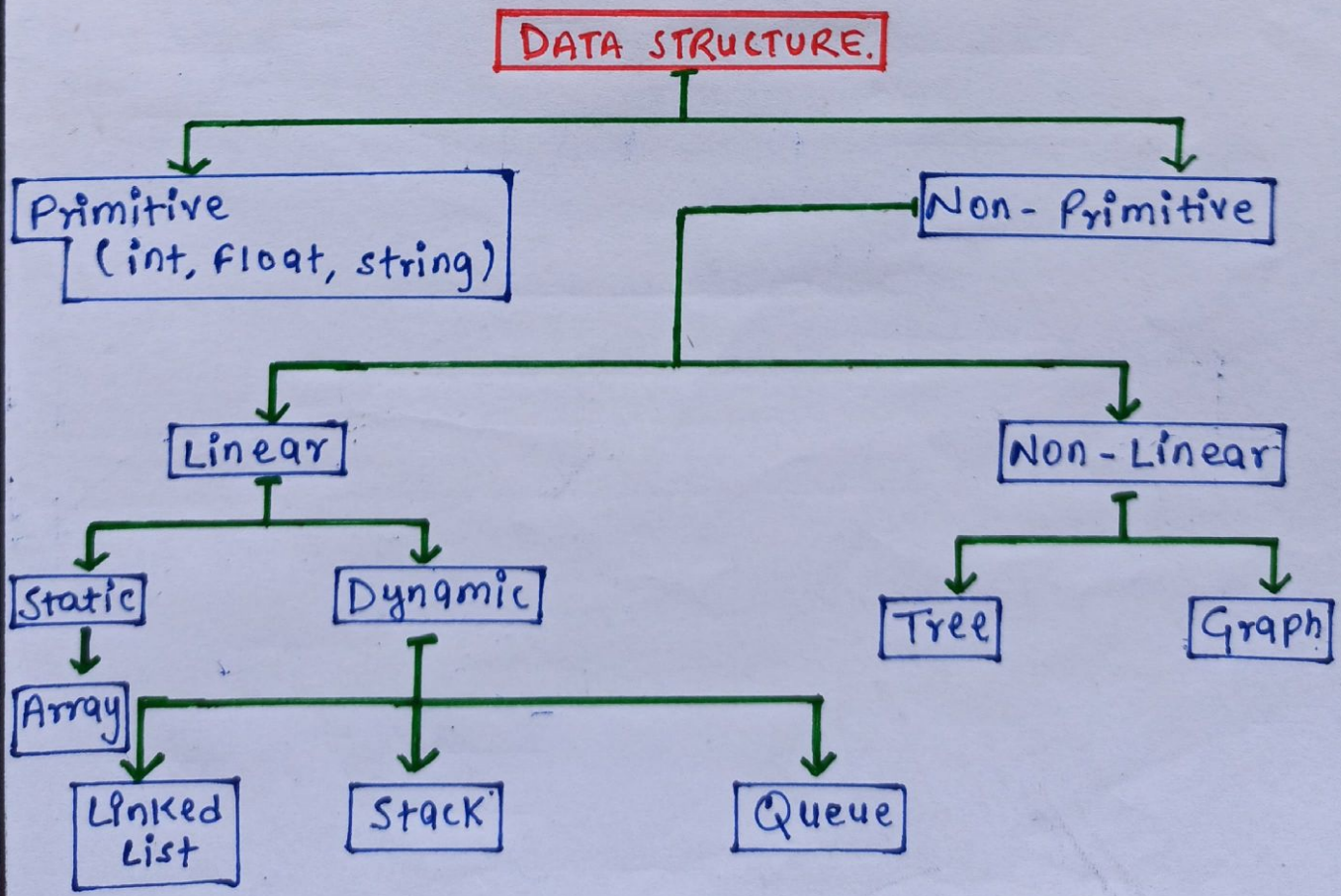
Examples: Array, linkedlist, stack, Queue, Tree Graph and many more.

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.

$C(n) = n/2$ ⟵ 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.

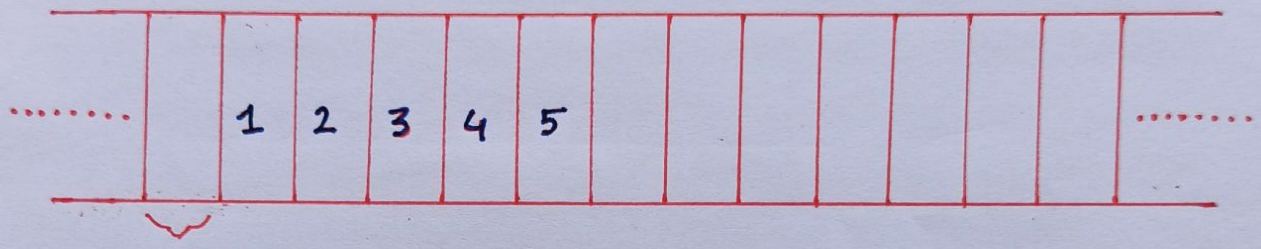
Binary search can be implemented only on a stored list of items.

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

$c(n) = \log_2 n$ ⟵ 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 computer 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.

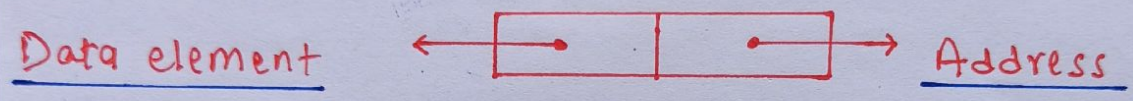
③ Multi-Dimentional Array :

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

LINKED LIST :-

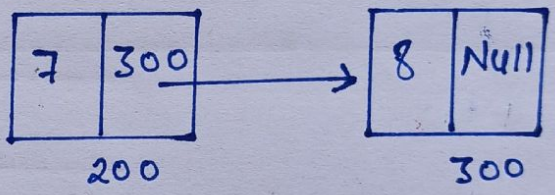
Linked list is a linear Data structure. it is also a collection of more than one data items of a disimilar data type like array but it can not stored it in contigues memory location. It can be stored randomly in a main memory.

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

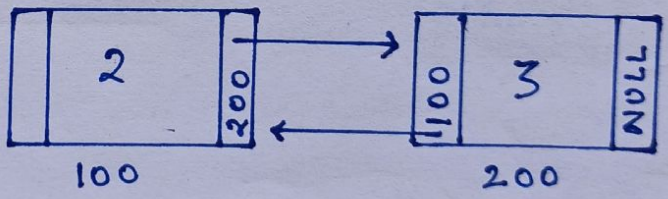


Types of linked list

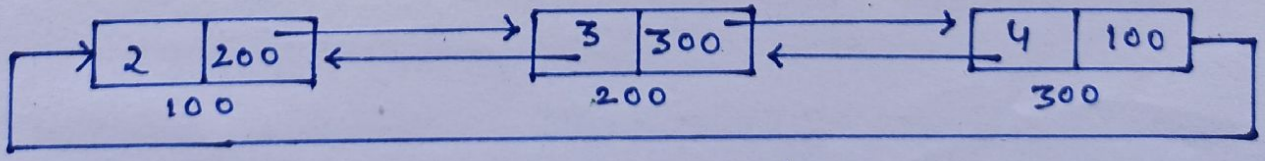
① Singly linked list :



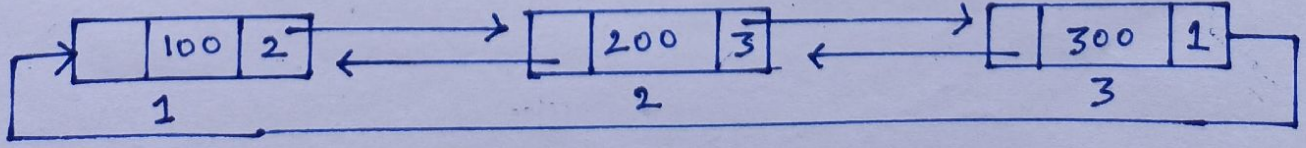
② Doubly linked list :



③ Circular linked list :

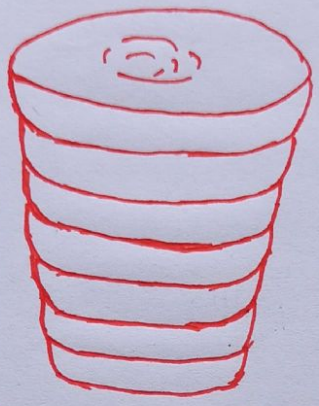


④ Doubly circular linked list :



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.



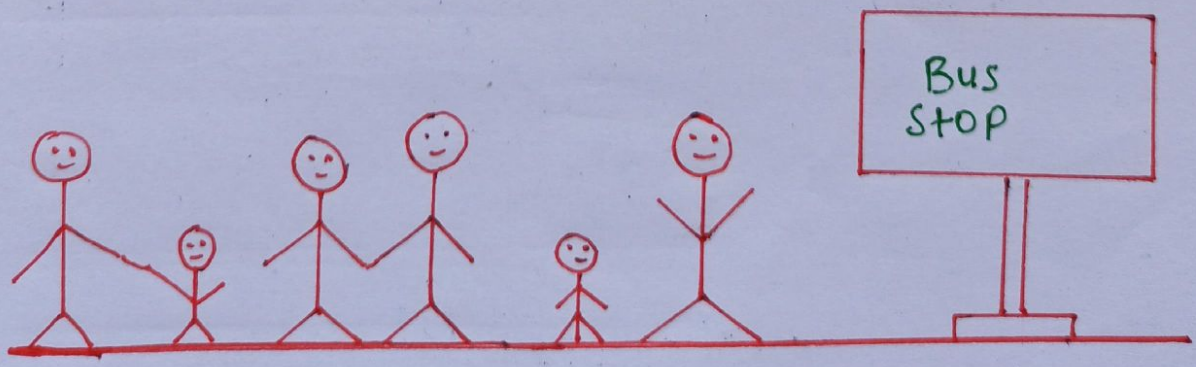
Stack of dishes

Push ⟶ Insert elements into stack

Delete elements from stack ⟵ **POP**

QUEUES

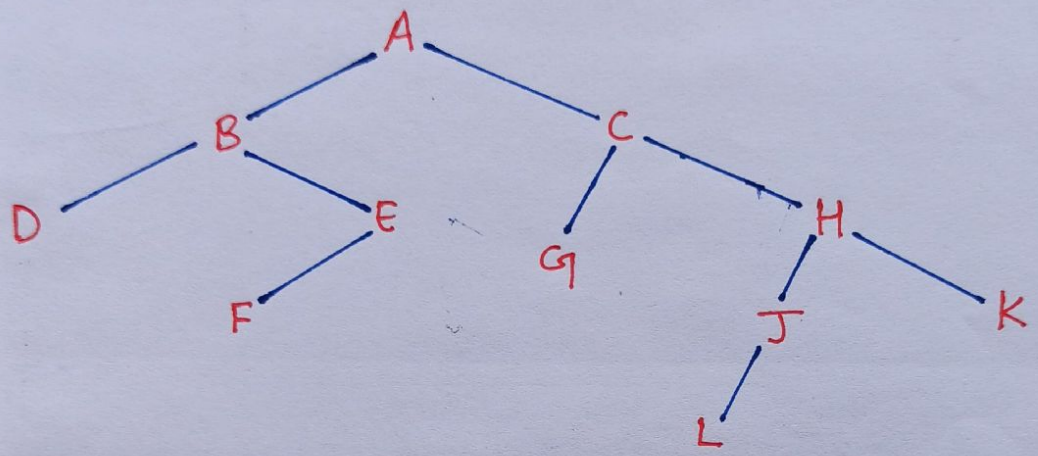
A Queue is a linear list of elements in which deletions can take place only at one end called **front** and insertions can take place only at the other end called the **rear**.



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,

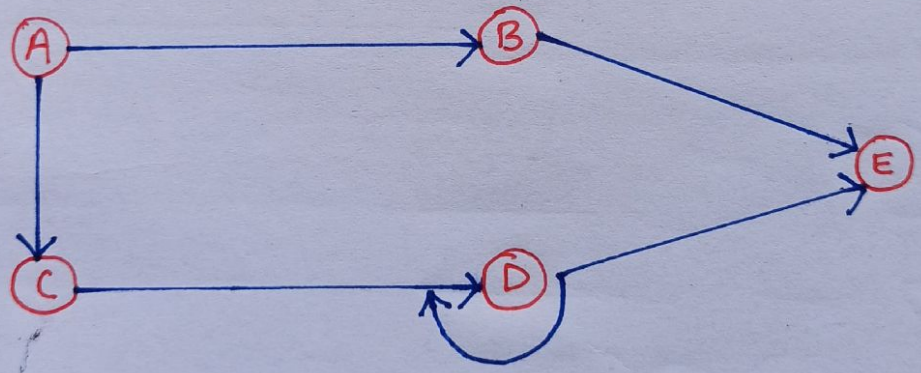
V ⟶ Vertiles / Nodes

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 vertiles



Representation of the graph

(A) Adjacency Matrix

(B) Adjacency List