

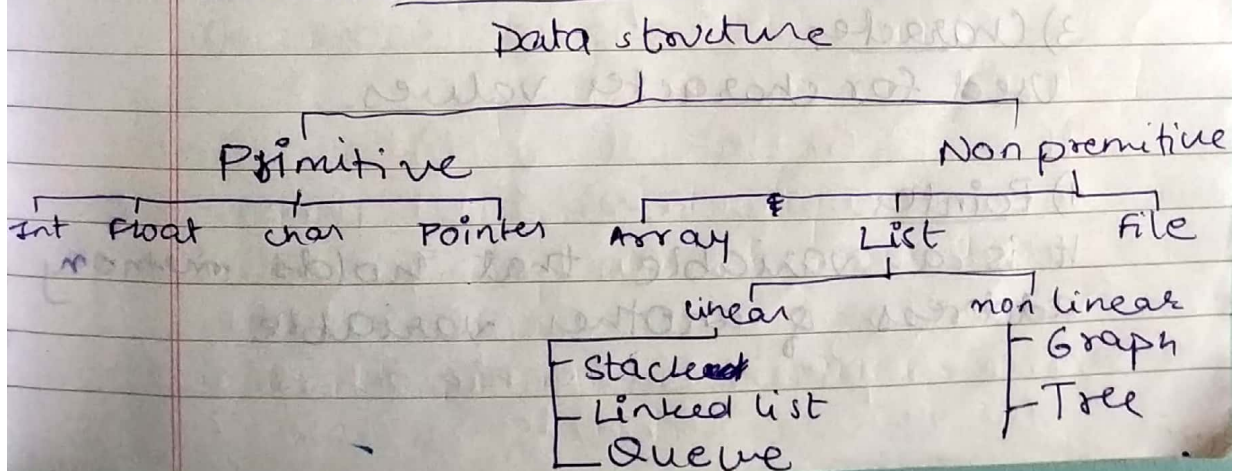
# Introduction to Data Structures

- Data structure is branch of computer science which gives knowledge of organizing and controlling the flow of data to reduce complexity & increase efficiency of the algorithm.
- Data structure is a representation of the logical relationship existing b/w individual elements of data.
- Algorithm + data structure = program.
- Data structure mainly specifies
  - Organization of data
  - Accessing methods
  - Degree of associating
  - Processing alternatives for info.

Data structure study covers following points:

- Amount of memory required to store
- Amount of time required to process
- Representation of data in memory
- Operations performed on that data

## Classification of data structures





Data structures are mainly classified into two broad categories.

1. Primitive data structure
2. Non-primitive data structure.

### Primitive

- They are basic structures and are directly operated upon by machine instructions.

- They have different representations on different computers.

Ex: Integer, float, character & pointer.

- These data types are available in most programming languages as a built-in type.

#### 1) Integer.

It is a data type which allows all values without fraction part. It is for whole nos.

#### 2) Float.

It is a data type which is used to store fractional numbers.

#### 3) Character

Used for character values.

#### 4) Pointer.

It is a variable that holds memory address of another variable.

## Non-Primitive

- These are most sophisticated data structure derived from primitive.
- They emphasise on structure of a grp of homogeneous or heterogeneous ds.
- Example Array, List, files

### 1) Array

Array is a fixed sized sequence of elements of same data type.

### 2) File

A file is a collection of logically related info. which can be view as a large list of records consisting of various fields.

### 3) List

It is a set of elements which can be further divided into linear data structures & non-linear data structures.

#### a) Linear

A data structure is said to be linear if its elements are connected in linear fashion by means of logically or in sequence memory location.

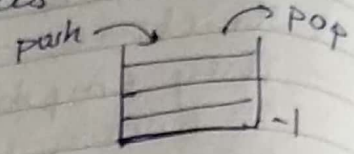
Ex: Stack, queue,

#### Stack

Stack is a data structure in which insertion & deletion operations are performed at only one end. The insertion operation is referred



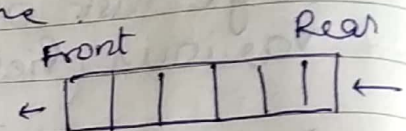
as push & deletion operation as pop  
Stack is also called as LIFO  
(Last in first out)  
Ex: cards, plates



Queue  
The data structure which permits the  
insertion at one end & deletion at  
another end is known as queue.  
End at which deletion occurs is known  
as front end & another end at which  
insertion occurs is known as rear end.  
Queue is also called as first in first out  
(FIFO) data structure.

Ex: queue for

standing in line.



- Possible operations on linear data structure  
are insertion, deletion, searching,  
sorting, merging & traversal.

Non-linear data searching

In it ~~data~~ data items are not  
arranged in a sequence

Ex: Tree or graph.

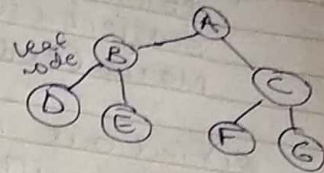
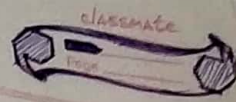
Tree

It is a finite set of data items,  
nodes, in which data items are  
arranged in branches & sub branches  
according to the requirement.

Tree represents the hierarchical relation  
b/w various elements



It consists of nodes connected by edge.

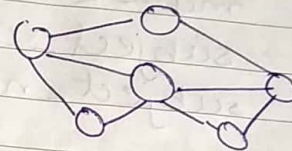


### Graph

It is a collection of nodes (information) & connecting edges. (logical relation b/w nodes)

A tree can be considered as restricted graph.

Graph can be of various types such as: undirected, directed, weighted etc.



### Need of data structures

In comp programming, data structure designed to store data for the purpose of working on it with various algorithms.

Each data structure contains info about the data values, relationships b/w the data & ft's that can be applied to the data.

### Application of D.S.

Data structure

↳ Primitive

↳ int

↳ float

↳ char

↳ Non primitive

↳ graph

↳ Array

↳ linked list

↳ structure

↳ Union

↳ stack

↳ queue

↳ Tree

→ searching

→ sorting

→ minimum spanning tree.