

Ch 1 : INTRODUCTION TO DATA STRUCTURE.

1. What is data and information.
2. Definition of data structure.
3. Operation performed on data structure.
4. Classification of Data Structure OR Types of Data Structure.
5. Difference between primitive and nonprimitive data structure.
6. Difference between List and Array .
7. Difference between Linear and nonlinear data structure.
8. What is Algorithm.
9. Analysis of Algorithm.

1. What is Data and Information.

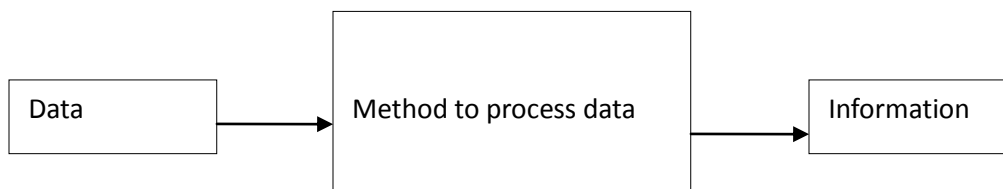
Ans:

Data:-

- Data is nothing but collection of information of numbers, alphabets, symbols.
- Data is raw fact or unprocessed information.

Information:-

- When data is processed, organized, structured or presented in a given context so as to make it useful, it is called information.
- Information is processed data. When data is processed it is called information.
- Information is derived from data.



Example:-

Data

- Each student's test score is one piece of data.

Information

The average score of a class or of the entire school information that can be derived from the given data.

2. **Definition of Data Structure**

Ans:

- Data may be organized in many different ways, the logical or mathematical model of particular organization of data is called data structure.
- Data structure is a particular way of storing and organizing data in a computer so it can be used efficiently.
- It is defined as the way of storing and manipulating data in organized form so that it can be used efficiently.

• **Data Structure covers:**

- Organization of data
- Accessing methods.
- Processing alternatives for information.
- Amount of memory required to store.
- Amount of time required to process.
- Representation of data in memory.
- Operation performed on that data.

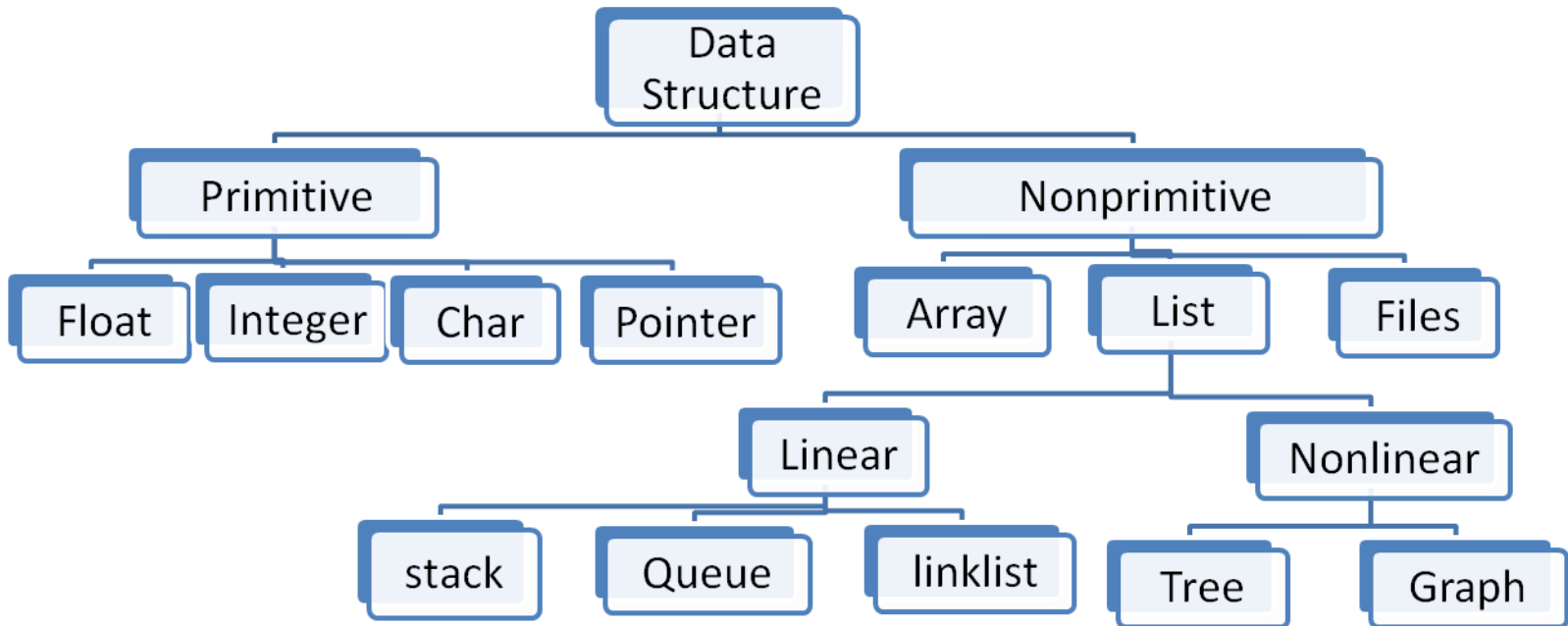
3. **Operation performed on data structure.**

- The possible operations on the data structure are:
 1. Create: Reserve some memory for program element.
 2. Destroy: Destroy(delete) some memory space allocated for specified data structure.
 3. Select: It access a particular data from data structure.
 4. Traversal : Accessing each data element once in such a way that all the data elements are processed.
 5. Insertion : Adding a new element into DS
 6. Deletion : Removing element from DS.
 7. Update : It update or modify data in the data structure.

- 8. Searching : Finding location for specific data in the array
- 9. Sorting : Arranging the data in logical order.
- 10. Merging : Combining the two data items into single data item..

4. Classification of Data Structure OR Types of Data Structure

Ans:



❖ Primitive Data Structure: The Data structure that directly operated upon by machine level instruction are called primitive data structure.

1. Integer:

- The number of objects are countable can be represented by integer.
- Integer can be positive or negative.
- It may represent from $2^{(n-1)}+1$ to $2^{(n-1)}-1$ where n depends on no. of bits used to constitute one word in computer.

2. Real:

- The number having fractional part i.e. decimal point is called real number.
- Ex 12.3,4.4

3. Character:

- Character data structure is used to store nonnumeric information.
- It can be letters [A-Z],[a-z],0-9,operators and special symbols.

- The method used to represent character is ASCII.

4.Pointer:

- Pointer is a variable which points to memory address .
- A variable that hold address of another variable is called pointer.

❖ Non Primitive Data Structure: The Data structure that does not directly operated upon by machine level instruction are called non primitive data structure.

- That are derived from primitive DS

1.Array:

- Array is a set of finite number of same elements .
- It means it contain one type of data only.
- Ex .int A[5] it contains 5 integer type number.

2. File:

- A File is a collection of logically related information.It can be viewed as a large list of records consisting of various fields.

3 .List

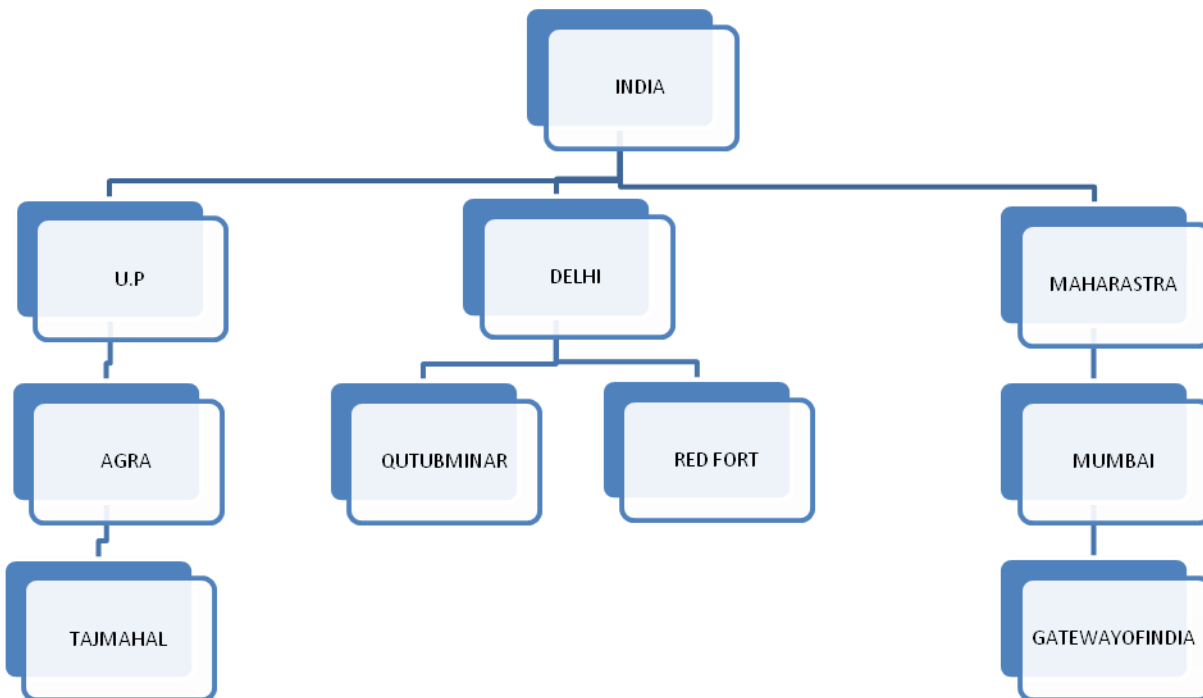
- List is ordered set of variable number of elements.
- There are two types of list.
 - Linear list
 - Non linear list

1. Linear list:-A data structure is said to be linear if its elements form sequence or linear list.

- Stack
- Queue
- Link list

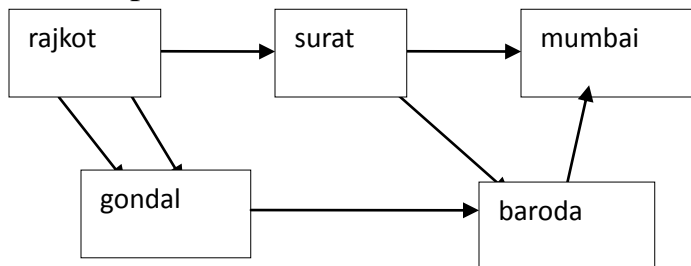
▪ Stack:

- A stack is linear list in which insertion and deletion can be done only from one end,called top of stack.
- It is called last in first out (LIFO)
- Ex: Bunch of plates placed on table people always takes off fresh plate from the top ,new plates are placed onto the bunch the top.
-



■ Graph:

- It is nonlinear data structure which represent many kind of physical structure.
- It is used to represent relational data.
- Ex: Roadmap of all cities.



5. Difference between primitive and nonprimitive data structure.

<u>Primitive</u>	<u>Nonprimitive</u>
1. They are simple and represent basic data item	1. They are complex and represent complex relationship among data item.
2. Storage structure is dependent on prog.lang.	2. Storage structure is decided by user

Data Structure

	based on application
3. Data structure that directly operated by machine instruction is called primitive data structure	3. Data structure that does not directly operated by machine instruction is called non primitive data structure
4. The basic data types provided by prog.lang. are primitive datas	4. User defined data type provided by prog.lang. are nonprimitive data
5. Ex :Integer,real,char,pointer	5. Ex:Array,stack,queue,link list ,tree ,graph

6. Difference between List and Array .

<u>List</u>	<u>Array</u>
1. List is ordered set of element	1. Array is unordered set of element
2. It consist of variable number of element	2. It consist fixed no of element
3. Insertion and deletion Can be performed easily.	3. Insertion and deletion can not be performed easily
4. It does not need movements of nodes for insertion and deletion	4. It needs movements of nodes for insertion and deletion
5. There are two types of list 1.linear list 2.non linear list	5. There are three types of arrays 1.one dimensional 2.two dimensional 3.multi dimensional
6. Location can not be easily accessible	6. Location can easily accessible
7. Address calculation is complicated	7. Address calculation is very easy because memory allocated sequentially
8. Different amount of time is required to access each element according to requirements	8. same amount of time is required to access each element .
9. Space is not wasted	9. Space is wasted
10.If we want to go particular node then we Have to go through all those nodes that Come before that node	10. If we want to go particular node then we can reach there directly.

7. Difference between Linear and nonlinear data structure.

<u>Linear</u>	<u>NonLinear</u>
A data structure is said to be linear if its elements form sequence or linear list.	A data structure is said to be non linear if its elements do not form sequence or linear

	fashion.
Every item(value) is related to its previous and next item.	Every item is attached with many other items.
Data items can be traversed in a single run.	Data items can not be traversed in a single run.
Implement is easy	Implement is difficult
Ex: Array,stack,linked list ,queue	Ex:tree,graph

8. What is Algorithm

Ans:

- Algorithm is a precise plan for performing sequence of actions to achieve purpose.
- It is step by step finite sequence of instruction to solve any problem.
- It is sequence of computational steps that transform input to output.
- Algorithm has following features or properties.
 - Input: Inputs must be provided .
 - Output: Algo. Must have one or more output
 - Finiteness : Each instruction is clear and unambiguous
 - Effectiveness: Each instruction must be so enough to understand by user.
- Applications.
 - Many algorithms are useful in broad area of computer applications, they include algorithm for sorting, searching, text processing, solving graph problem, geometric problem and perform common mathematical calculation.

9. Analysis of Algorithm.

Ans

- Analysis it means To discover its characteristics in order to evaluate its efficiency for various applications.
- We have many algorithms for same situation. Some algorithms are more efficient than others. We would like to choose efficient algorithm .
- So through analysis we can choose best algorithm from many.
- Complexity of algorithm is function describing the efficiency of the algorithm .
- There are two main complexity measures of the efficiency of algorithm.
- 1. Time complexity 2. Space complexity

Data Structure

- ❖ 1. Time complexity: It is a function describing the amount of time an algorithm takes in terms of the amount of input to the algorithm.
 - It means: Number of memory accesses performed,
 Number of comparisons between integers.
 Number of times some inner loop is executed.
- ❖ 2. Space complexity:- It is a function describing the amount of memory(space) an algorithm takes in terms of the amount of input to the algorithm.
 - It means: It is measure of how much storage is required by algo.
 It is amount of computer memory required during prog.
- ❖ Three type of analysis(complexity):-
 - Best case complexity: Best case complexity of algo. is function defined by minimum number of steps taken on any instance of size. Or when sorting tech. have minimum number of comparisons occurs.
➤ Ex: if searching no is 1 and i/p : 1 2 3 4 5
 - Worst case complexity: Worst case complexity of algo. is function defined by maximum number of steps taken on any instance of size. Or when sorting tech. have maximum number of comparisons occurs.
➤ Ex: if searching no is 1 and i/p : 2 3 1 4 5
 - Average case complexity: Average case complexity of algo. is function defined by Average number of steps taken on any instance of size. Or when sorting tech. have Average number of comparisons occurs.
➤ Ex: if searching no is 1 and i/p : 5 2 3 4 1

Gtu Question

1. Write short note on performance analysis and performance measurement of an algorithm. -7
2. Define data structure. -1
3. What is worst case time complexity of searching an element in a list?how? -1
4. Define primitive data structure -1
5. Explain space and time complexity. -1

6. Explain various linear and nonlinear data structure. Along with their application. -7