

Disha College

Data Structure BCA III

Subject Teacher
Seema Pathak

Syllabus

Data Structure **Subject Code - BCA-305**

Max Marks : 80

Min Marks : 27

Note : The Question Paper setter is advised to prepare unit-wise question with the provision of internal choice. Only Simple calculators allowed not scientific calculator.

UNIT – I INTRODUCTION –

Introduction, Basic terminology, Elementary data organization, Data structure, Data structure operation, Algorithms: complexity, time-space Tradeoff. Mathematical Notation and functions, Algorithmic Notation

UNIT – II

CONCEPTS OF ARRAYS, RECORDS AND POINTERS –

Basic Terminology, Linear Array; Single Dimensional Array, Multidimensional Array, Static Array, Dynamic Array; **Pointers:** Introduction of Pointer, **Records:** Record Structures.

UNIT – III

LINKED LISTS, STACKS, QUEUES, RECURSION –

Link lists, Traversing a linked list, searching a linked list; Insertion into a linked List, Deletion from a Linked List, Stacks, Array Representation of Stack; Queues.

UNIT – IV

TREES -

Binary Trees, Representing Binary Trees in Memory, Traversing binary tree, Traversal Algorithms using stacks, header nodes; threads, Binary Search Tree, Searching and Inserting in Binary Search Tree, Deleting in Binary Search tree

UNIT - V

SORTING AND SEARCHING –

Sorting: Bubble Sort, Quick Sort, Insertion Sort, Selection Sort, Merge Sort; **Searching:** Liner Search, Binary Search, Searching and data modification, Introduction to hashing.

Why Data Structure

Organizing or structuring data is vital to the design and implementation of efficient algorithms and program development. Any discipline in science and engineering that requires efficient problem solving using computers, uses the appropriate data structures during program development. The study of data structure is an essential part of virtually every UG and PG program in computer science.

Suggested books

1. “Data Structures” , Lipschutz, Schaum’s Outline Series, Tata Mcgraw-hill Education (India) Pvt. Ltd .
- 2.“Data Structures Using C and C++”, . Aaron M.Tenenbaum, PHI Learning Private Limited
3. “Fundamentals of Data Structures”, Horowitz and Sahani, Galgotia Publications Pvt Ltd
4. “Data Structure Using C”, A.K. Sharma , Pearson Education
5. “Data structure using C”, E Balaguruswamy, Mcgraw Hill .
6. “Data Structures and Program Design in C”, R. Kruse, Pearson Education
7. “Data Structures with C”, Reema Thereja, Oxford Press.

Unit 1

Introduction, Basic terminology, Elementary data organization, Data Structure, Data structure operation, Algorithms, complexity, time-space tradeoff, Mathematical notations and functions, Algorithmic Notation

Basic Terminology

Data: Data are value or collection of values.

Data are simply collection of facts and figures.

Data item: A data item refers to a single unit of value. Data item may be–

Elementary data item: are those that can not be divided into parts. Ex. ID, age, gender

Composite or group data item: are those that can be divided into parts. Ex. Name, address, DOB

Elementary data organization

Entity: An entity is something that has certain attributes or properties which may be assigned some values.

Ex.	attribute	name	Age	Gender
	value	Naresh	25	M
		Heena	31	F

Entity Set: An entity set is a set of similar entities. Ex. Student, Employee

Elementary data organization

Data can be simply organized in the form of fields, records and files.

Field: A field is a single elementary unit of information representing an attribute of an entity. It contains similar type of information, Ex. Name, city, color etc.

Elementary data organization

Record: A record is the collection of related fields of given entity.

File: A file is the collection of records of the entities in a given entity set.

Elementary data organization

Bid	Title	Author	Price
11	Franklin forgets	Bourgeois	7.00
22	Arthur and the Seventh-Inning Stretcher	Krensky	14.00
33	Midnight Wrestlers	Morgan	11.00
44	Midnight Pilot	Morgan	9.00
55	Book of Science Activities		18.00

Data Structure

- Data structure is the study of organization of data and information in computer memory.
- Data structure is the representation of logical relationship between existing data elements.
- The logical or mathematical model of particular organization of data is called data structure.

Data Structure

The choice of a particular data model depends on two considerations:

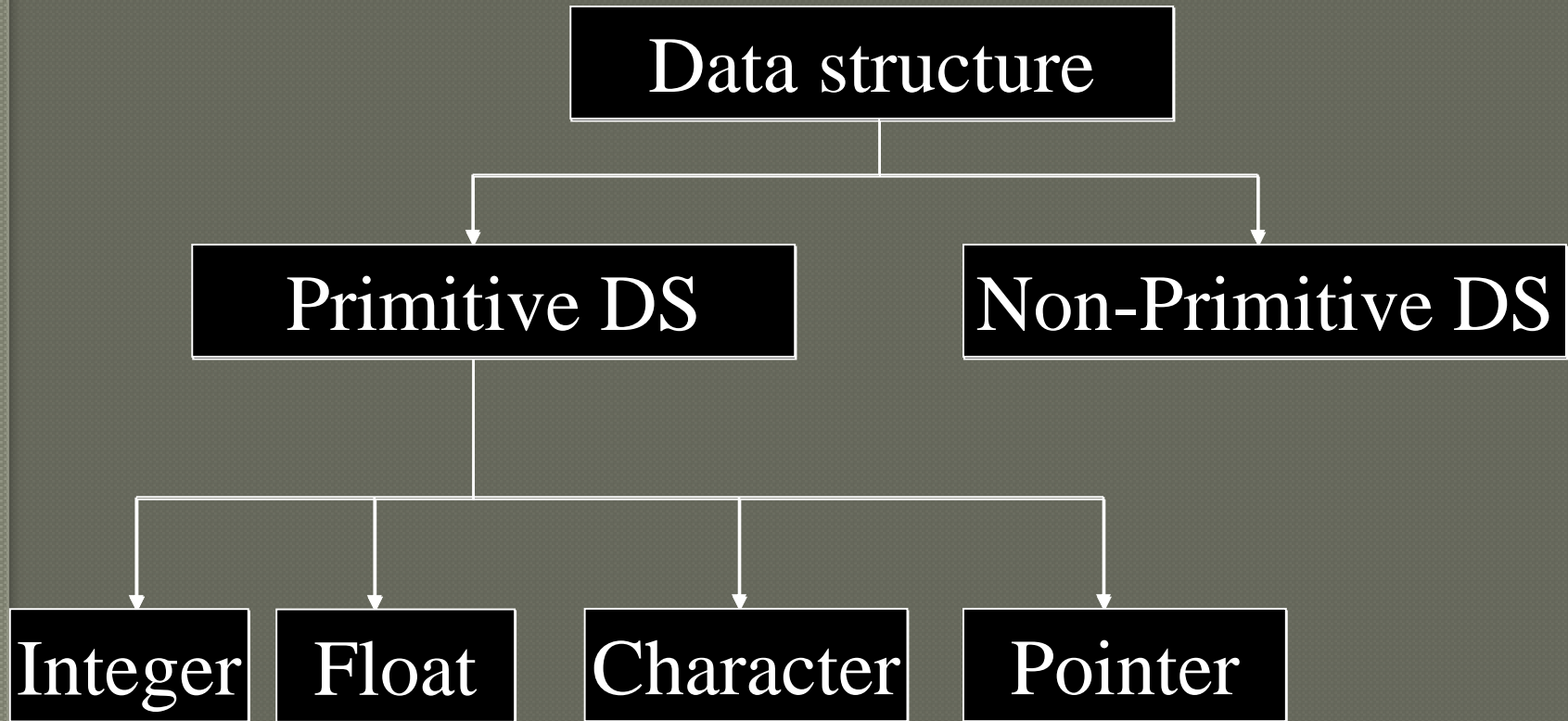
- i) it must be rich enough in structure to mirror the actual relationship of the data in the real world.
- ii) the structure should be simple enough that one can effectively process the data.

Classification of data structure

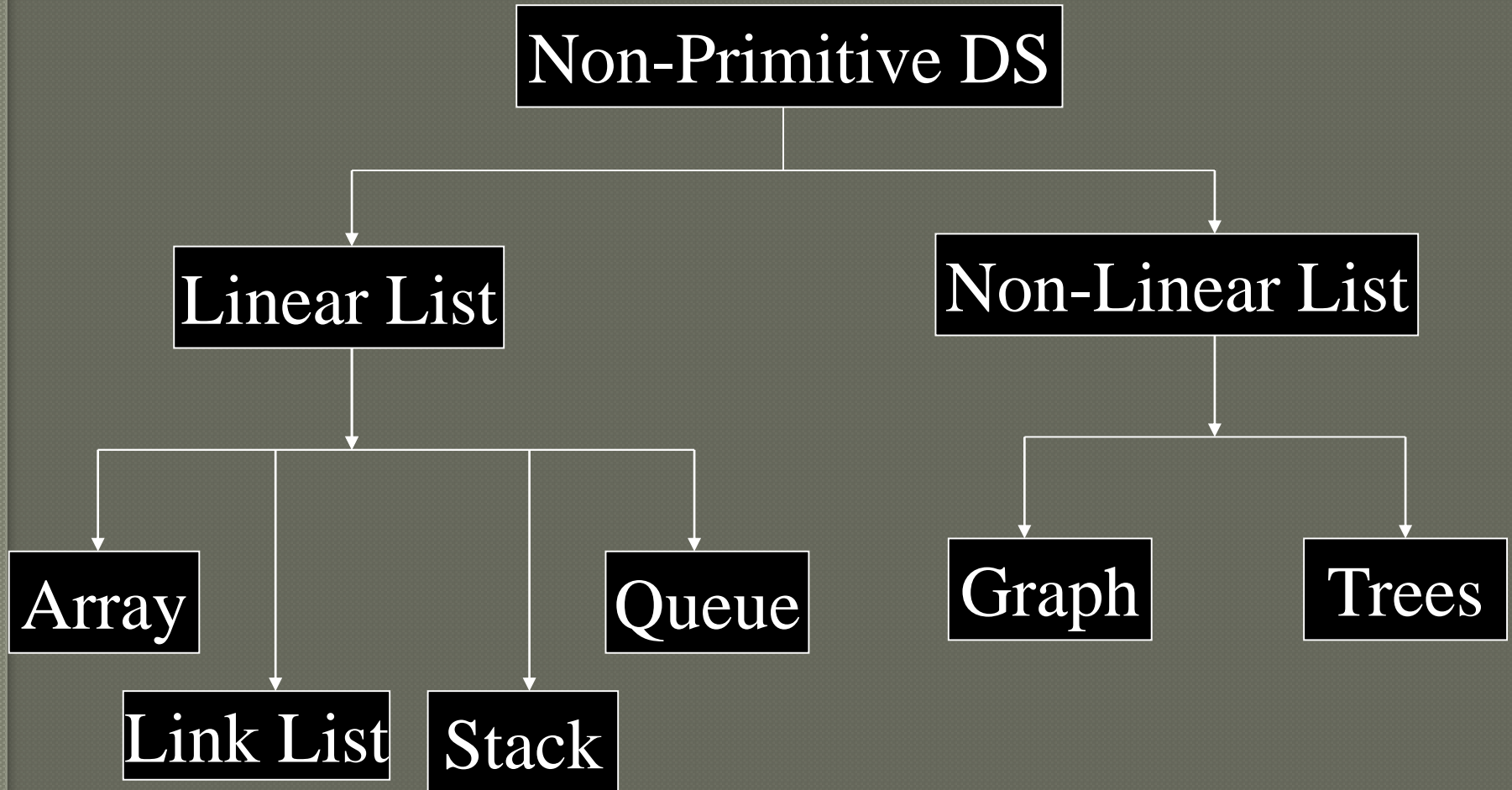
Data structure are normally divided into two broad categories:

- Primitive Data Structure
- Non-Primitive Data Structure

Classification of Data Structure



Classification of Data Structure



Primitive data structure

- These are basic structures that can not be divided into parts.
- They contain single value.
- These are directly operated upon by the machine instructions.
- In general, there are different representation on different computers.
- Integer, Floating-point number, Character constants, string constants, pointers etc, fall in this category.

Non-Primitive Data Structure

- These are more sophisticated data structures.
- These are derived from the primitive data structures.
- The non-primitive data structures emphasize on structuring of a group of homogeneous (same type) or heterogeneous (different type) data items.
- Lists, Stack, Queue, Tree, Graph are example of non-primitive data structures.

Other Classifications

On the basis of linearity

- Linear data structure
- Non linear data structure

On the basis of size

- Static data structure
- Dynamic data structure

On the basis of type of elements

- Homogeneous data structure
- Non homogeneous data structure

Linear and Non-linear Data Structures

- **Linear Data Structure:** Linear data structures can be constructed as a continuous arrangement of data elements in the memory. It can be constructed by using array data type. In the linear Data Structures the relationship of adjacency is maintained between the data elements.
- **Non-linear Data Structure :** Non-linear data structure can be constructed as a collection of randomly distributed set of data items joined together by using a special pointer (tag). In non-linear Data structure the relationship of adjacency is not maintained between the data items.

Static and Dynamic Data Structure

- **Static Data Structure:** Static data structure are those data structures whose size is declared when they are created and can not be changed.
Ex. Integer, float, string, array
- **Dynamic Data Structure:** Dynamic data structures are those data structures whose size can be changed during execution.
Ex: Linked list

Homogeneous and Heterogeneous data structure

- **Homogeneous data structure:** All the data elements of homogeneous data structure are of same data type.
Ex. Array
- **Heterogeneous data structure:** All the data elements of heterogeneous data structure are of different data type.
Ex. Record, tree, graph

Data structure operations

The most commonly used operation on data structure are broadly categorized into following types:

- Creation
- Insertion
- Traversal
- Deletion
- Search
- Sort

Array

- An array is a linear, static, homogeneous data structure.
- An array is defined as a set of finite number of homogeneous elements referenced by common name.
- It means an array can contain one type of data only, either all integer, all float-point number or all character.
- The elements of array will always be stored in the consecutive (continues) memory location.
- Array is the simplest data structure among all structures.

A[0] A[1] A[2] A[3] A[4]

● A[4]

10	20	12	66	31
----	----	----	----	----

Stack

- ◉ Stack is a linear data structure.
- ◉ A stack is an ordered collection of elements with special feature that deletion and insertion of elements can be done only from one end called the top of the stack (TOP)
- ◉ Due to this property it is also called as Last In First Out type of data structure (LIFO).
- ◉ When an element is inserted into a stack or removed from the stack, its base remains fixed where the top of stack changes.

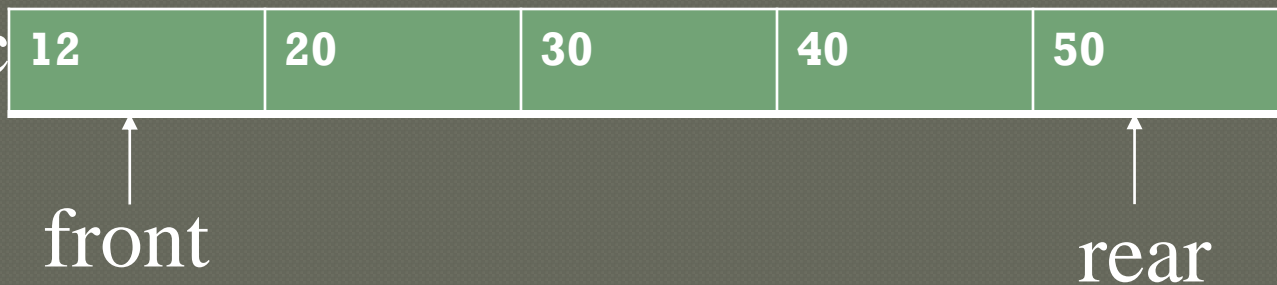
Stack

- The bellow show figure how the operations take place on a stack:



Queue

- Queue are first in first out type of data structure (i.e. FIFO)
- In a queue new elements are added to the queue from one end called REAR end and the element are always removed from other end called the FRONT end.
- The bellow show figure how the operations take plac

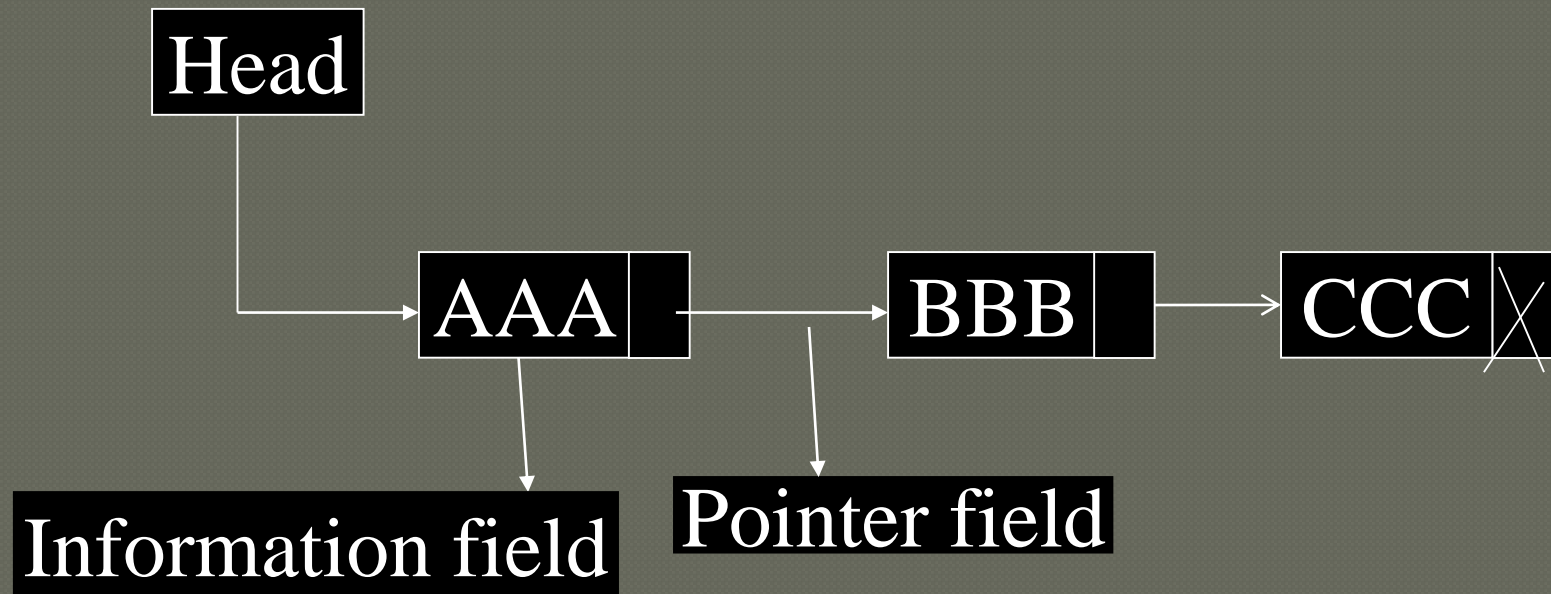


Linked List

- A lists (Linear linked list) can be defined as a collection of variable number of data items.
- Lists are the most commonly used non-primitive data structures.
- An element of list must contain at least two fields, one for storing data or information and other for storing address of next element.
- As you know for storing address we have a special data structure of list the address must be pointer type.

Linked List

Technically each such element is referred to as a node, therefore a list can be defined as a collection of nodes as show bellow:

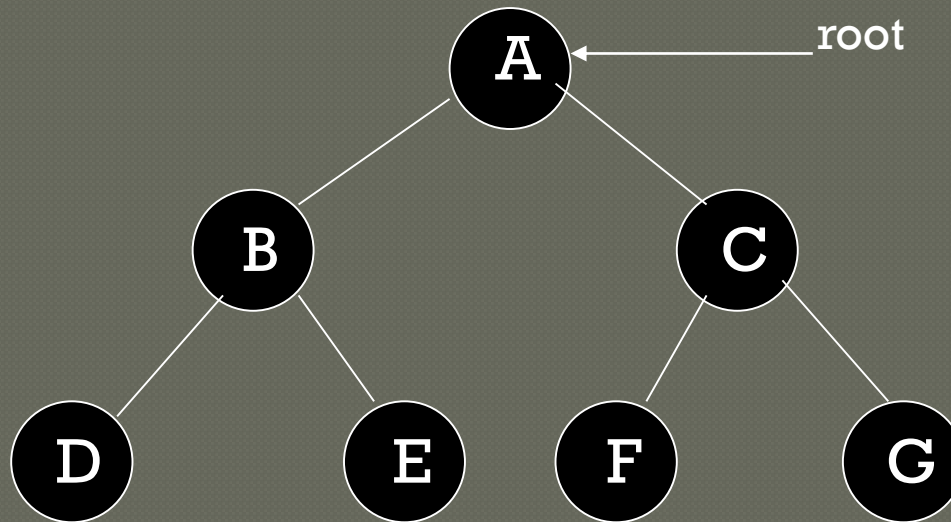


Tree

- A tree can be defined as finite set of data items (nodes).
- Tree is non-linear type of data structure in which data items are arranged or stored in a sorted sequence.
- Tree represent the hierarchical relationship between various elements.

Tree

- The tree structure organizes the data into branches, which related the information.



Graph

- Graph is a mathematical non-linear data structure capable of representing many kind of physical structures.
- It has found application in Geography, Chemistry and Engineering sciences.
- Definition: A graph $G(V,E)$ is a set of vertices V and a set of edges E .

Thank You