Module 1 : Introduction to Data Structures

Lifna C.S, Richa Sharma, Sujata Khandaskar
Faculty Incharge for CSC 703
Department of Computer Engineering
VES Institute of Technology, Mumbai

CSC 303 : Data Structures (CBCGS - Rev. 2019 'C' Scheme)

Prerequisites

- Knowledge of C Programming Language

Text / Reference Books

Text Books :

1. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, “Data Structures Using C”, Pearson Publication.
2. Reema Thareja, “Data Structures using C”, Oxford Press.
3. Richard F. Gilberg and Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, 2nd Edition, CENGAGE Learning.
4. Jean Paul Tremblay, P. G. Sorenson, “Introduction to Data Structure and Its Applications”, McGraw-Hill Higher Education
5. Data Structures Using C, ISRD Group, 2nd Edition, Tata McGraw-Hill

Text / Reference Books

Reference Books :

1. Prof. P. S. Deshpande, Prof. O. G. Kakde, “C and Data Structures”, DreamTech press.
2. E. Balagurusamy, “Data Structure Using C”, Tata McGraw-Hill Education India.
3. Rajesh K Shukla, “Data Structures using C and C++”, Wiley-India
4. GAV PAI, “Data Structures”, Schaum’s Outlines.
5. Robert Kruse, C. L. Tondo, Bruce Leung, “Data Structures and Program Design in C”, Pearson Edition

What are Data Structures?

- A **data structure** is a particular way of organizing data in a computer so that it can be used effectively.

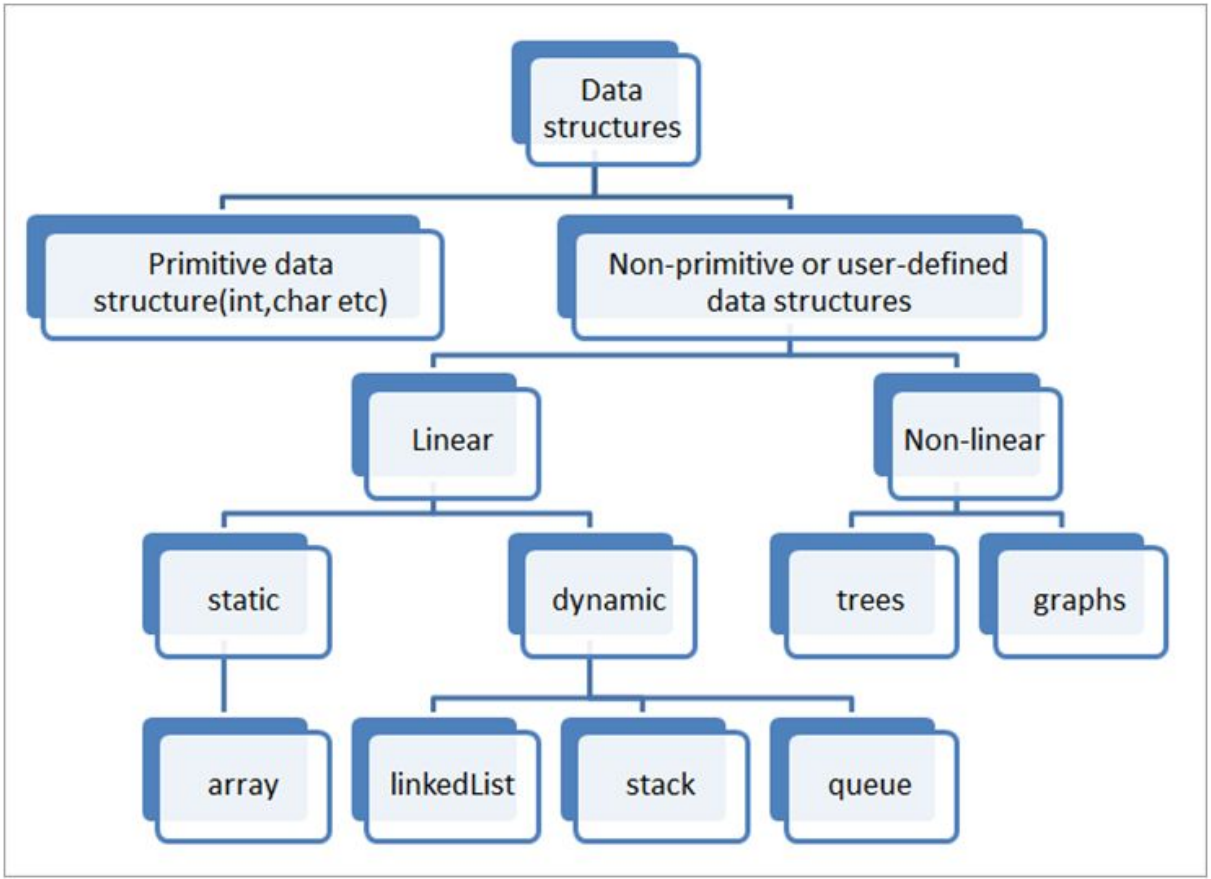
- In other words, a data structure is a way of organizing all data items that considers not only the elements stored but also their relationship to each other

Program = Algorithms + Data Structures

- ★ An **algorithm** is a set of instruction or a step by step procedure written to carry out certain tasks or solve a particular function.

- ★ A **data structure** is the way of organizing the data with their logical relationship retained.

Classification of Data Structures



Linear Data Structure

- ★ A data structure is called **linear** if all of its elements are arranged in the linear order.
- ★ In linear data structures, the elements are stored in **non-hierarchical way** where each element has the successors and predecessors except the first and last element.

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Static Data Structure

★ In Static data structure the size of the structure is **fixed**.

★ The content of the data structure can be modified but **without changing the memory space** allocated to it.

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Dynamic Data Structure

★ In Dynamic data structure the **size of the structure in not fixed** and can be modified during the operations performed on it.

★ Dynamic data structures are designed to facilitate change of data structures in the run time.

Array

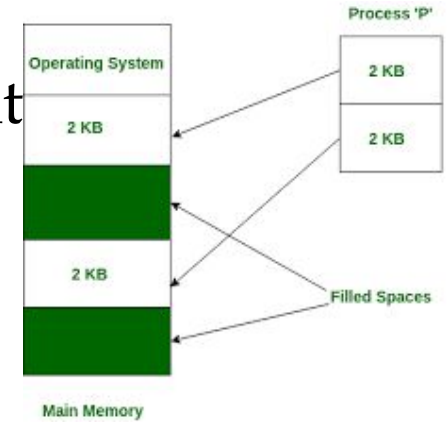
- ★ An array is a collection of **similar type of data items** and each data item is called an element of the array. The data type of the element may be any valid data type like char, int, float or double.
- ★ The elements of array share the **same variable name** but each one carries a different index number known as **subscript**. The array can be one dimensional, two dimensional or multidimensional.

Linked List

★ Linked list is a linear data structure which is used to **maintain a list in the memory**.

★ It can be seen as the collection of nodes stored at **non-contiguous memory locations.**

★ Each node of the list cont **pointer to its adjacent node**.



Stack

★ Stack is a **linear list** in which insertion and deletions are allowed only at one end, called **top**.

★ A stack is an **Abstract Data Type (ADT)**, can be implemented in most of the programming languages. It is named as stack because it behaves like a real-world stack, for **example: - piles of plates or deck of cards etc.**

Queue

- ★ Queue is a linear list in which elements can be inserted only at one end called **rear** and deleted only at the other end called **front**.
- ★ It is an abstract data structure, similar to stack. Queue is opened at both end therefore it follows **First-In-First-Out (FIFO)** methodology for storing the data items

Non Linear Data Structures

★ This data structure does not form a sequence i.e. each item or element is connected with two or more other items in a non-linear arrangement.

★ The data elements are not arranged in sequential structure.

Non Linear Data Structures - Trees

- ★ Trees are multilevel data structures with a hierarchical relationship among its elements known as nodes.
- ★ The bottommost nodes in the hierarchy are called **leaf node** while the topmost node is called **root node**.
- ★ Each node contains pointers to point adjacent nodes
- ★ Tree data structure is based on the parent-child relationship among the nodes.
- ★ Each node in the tree can have more than one children except the leaf nodes whereas each node can have atmost one parent except the root node

Non Linear Data Structures - Graphs

★ Graphs can be defined as the **pictorial representation of the set of elements** (represented by vertices) connected by the links known as edges.

★ A graph is different from tree in the sense that a graph can have cycle while the tree can not have the one