



Unit II

Data Structure



Data Structure ???

- ❖ One of the **basic technique for improving algorithms** is to **structure the data** in such a way that the resulting operations can efficiently carried out.
- ❖ Two Categories of Data structures are:
 - ❖ Linear data structure (elements form a sequence)
e.g. array, list, queue, stack, etc
 - ❖ Non-linear data structure (elements do not form a sequence)
tree, binary tree, graph, etc



Linear Data Structure Representation

Generally, there are two ways of representing linear data structure in memory

1. **Arrays**

Have the linear relationship between the elements by means of sequential memory locations

2. **Linked Lists**

Have linear relationship between the elements represented by means of pointers or links



Linear Data Structure Representation

Arrays : is a finite collection of **similar** elements stored in **consecutive** memory locations.

e.g.

An array **a[5]={ 4, 5, 2, 6, 7}**

First element 4 is stored in 0th memory location

Last element is stored in 4th memory location.

If the base address of array **a** is 200 then what is the address of each element?



Linear Data Structure Representation

Set of Operations perform on an array

- ❖ Traversal :
processing each element in the array
- ❖ Search :
finding the location of an element with a given value
- ❖ Insertion
- ❖ Deletion
- ❖ Sorting
- ❖ Merging
- ❖ Reversing



Linear Data Structure Representation

Advantage of using Array

- ❖ *Simple to understand*
- ❖ *Elements of an array are easily accessible*

Drawbacks:

- ❖ Arrays have fixed size. Once an array size is decided , it can not be changed during execution.
- ❖ Wastage of memory space
- ❖ Array elements are stored in consecutive memory locations. At times, if enough contiguous memory locations are not available in memory, an array can not be created.
- ❖ Insertion/deletion operations are tedious as each elements has to be shifted one position to the right /left.

The **solution to overcome these drawback is using Linked List**



Linear Data Structure Representation

Linked List : is a finite collection of **similar** nodes linked together

- ❖ each node has got two fields (data & link)
 - ❖ data field contains an element
 - ❖ link field points to the node containing the next element in the list.
- ❖ Link field of the last node is zero or null pointer
- ❖ Unlike array, individual elements in linked list are stored **any free memory location** and **not necessarily** be in the consecutive locations.
- ❖ Order of elements is maintained by explicit link between them.



Linear Data Structure Representation



Set of Operations on Linked List:

1. Traversing the Nodes
2. Searching for a Node
3. Prepending Nodes
4. Removing Nodes