18/11/25

Time & Space Complexity

8/12/25

Data Structure

DS is a way to store, organize and manage data in a computer to store and access data efficiently

example Array, LinkedList, Stacks, Queue, Tree, Graph, Hash table.

Best way to choose DS for prb

1. Analyse the required operation.
2. estimate time and space needed for operation.
3. Choose correct DS to support operation efficiently

Type of DS

1) Primitive DS
   Basic Data type like int, float, double, char, bool
2) Non-Primitive DS
   Created using primitive type (eg Array, LinkedList, tree, graph, queue, stack etc...

Further Divided into

1) Linear Data Structure
   Data arranged in sequence (eg) Array, LinkedList, Stack, queue
2) Non-Linear Data structure
   Data arranged in hierarchy or in network (eg) Tree, Graph.

Operation of DS

1) Traversal - accessing each data item exactly once to process it
2) Searching - Find location of data
3) Insertion - Add new data (Beginning, end, desire position)
4) Deletion - remove data (Beginning, end, any position
5) Sorting - data item in ascending / descending
6) Merging - combing two list into one list

Abstract Data type (ADT) | Information Hiding.

In Abstract Data type it only show what data is? and what operation is performed? not how actually it was implemented.

(eg) (i) int → addition, subtraction, gcd, sqrt

(ii) Real number → represent by decimal, support arithmetic operation and ordering

(iii) Book ADT → contain • name, author, ISBN • compare difficulty, search etc..

Advantage of ADT

i) can change internal data structure without changing whole program.

ii) easy to update and maintain

iii) reduce rewriting code & less error-prone.

Array in Data Structure

Array is fixed size sequenced collection of data items of same data type.

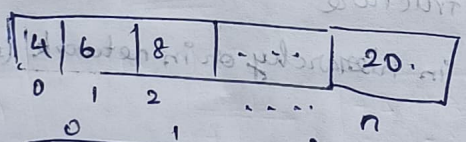
→ It can be accessed through index ⇒ arrayname[index]

type → 1-D Array

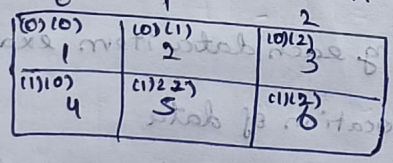
→ 2-D Array

→ Multi-dimensional Array

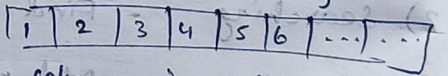
1-D array



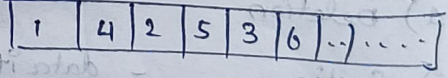
2D array



row major → data stored row wise in memory



column major → data stored column wise in memory



insert, delete, find, all operation done through traversal using loop.

multi-dimension array → more than 2 rows (or) column (or) both