

* What is data structure? Explain its type and components?

A data structure is the organization of data in a computer's memory or within a file on disk using a specific model. When we working with the huge amount of data of an organization, we must know how to manage or organize data smoothly and electronically.

Data may be arranged in many different ways such as the logical or mathematical model for a particular organization of data is termed as a data structure.

"The organized collection of data is called a Data structure."

"A data structure is representation of data and the operation allowed on that data."

[Data structure = Organized data + allowed operations]

* Classification of data structure -

i) According to type of data-

a) Homogenous data structure -

In homogenous data structure, the data elements are of the same type like an array data structure.

b) Non-homogenous data structure -

Non-homogenous data structure may not be of same type like struct or abstract data type.

2) A/c to storage allocation time -

a) Static data structure -

Static structures are ones whose size and structure associate memory location are fixed at compile time.

Eg:- Array

b) Dynamic data structure -

Dynamic data structures are ones that expand or shrink as required during the execution of program and their associated memory location change i.e pointers.

3) On the Basis of storage sequence -

a) Linear data structure -

A data structure is said to be linear if its element form a sequence processing of data item is possible in a linear fashion or one by one sequentially like in an array.

These are two basic ways of representing such a linear structure in memory -

i) One way is to have the linear relationship b/w the elements by means of sequential memory location, such linear structure are called array.

ii) The other way is to have the linear

relationship b/w the elements by means of sequential memory locations representing by means of pointers such linear structures are called linked lists. Stack and queue are also uses linear structure.

* Example of linear data structure are array, linked list, stack and queue.

b) Non-linear data structure -

In non-linear data structure, the data elements are not in sequence that means insertion and deletions are not possible in a linear fashion.

* Tree and graph are example of non-linear data structure.

* Components of data structure -

i) Storage structure -

Organization of data in a specific context depends on two considerations, first it must be rich enough in structure to mirror the actual relationship of data with real world. On the other hand, the structure should be simple enough, so that one can effectively process the data when necessary.

ii) Algorithm -

An algorithm is a well defined list of steps for solving a particular problem.

One major purpose of this text is to develop efficient algorithms for the processing of data. It is a finite set of instructions that takes some data as input and transforms it into refined data. An algorithm is a tool for solving a well specified computational problem.

iii) Data structure operations -

The possible operations on the linear and non-linear data structure are -

a) Traversal -

Traversal is nothing but visiting each element exactly once times using a systematic approach.

b) Sorting -

Sorting means arranging the elements in order, so accessing of element from list is possible more fast.

c) Searching -

Searching is an important operation of data structure to find location of any element in list and allows to retrieve associated value.

d) Insertion -

Insertion is an operation, to insert a new element at proper position in the list.

e) Deletion -

Deletion means removing an element from a list.

f) Editing -

Editing is an important operation of data structure to edit the element of a list.

g) Merging -

Merging is an operation to combine two or more than two similar type of list-elements.

* Array data structure -

An array is defined as the collection of similar type of data items stored at contiguous memory locations. Array are the derived data type, so it can be declare of any of the basis data types (char, int, float, double) including struct user defined type.

An array is a group of data having common characteristics that shares a common name and the differentiated from one another by their position or index no. within the array.

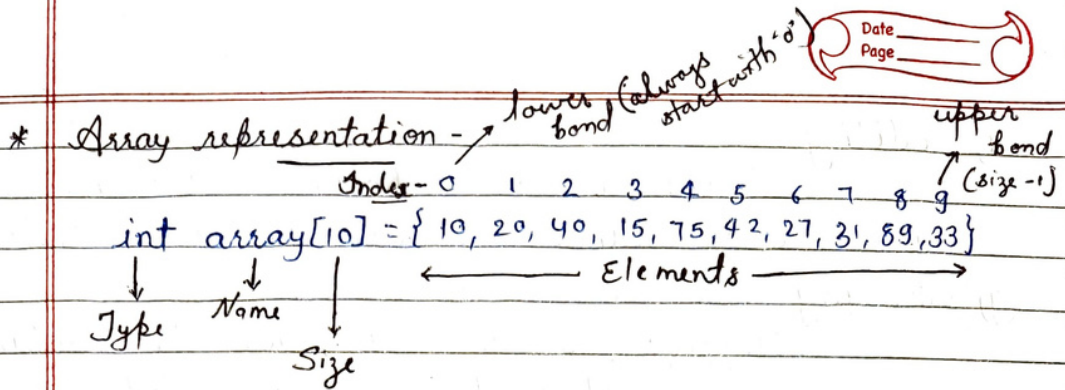
* Following are the important terms to understand the concept of array -

i) Element -

Each item stored in an array is called an element.

ii) Index -

Each location of an element in an array has a numerical index, which is used to identify the element.



As per the above -

- Index start with 0.
- Array length is 10 which means int it can store 10 elements.
- Each element can be accessed via its index no.

* Array uses subscript sign [], so it is also called subscript variable.

* In C-language strings are stored in char array that are handled slightly different than other arrays. Every char array (or string) has null ('\0') character as its last character which marks the end of string.

* Features -

- An array is linear data structure.
- An array is an example of static data structure. So the size of array always remains the same at run time i.e. fixed dimension.
- An array is a homogeneous structure.
- An array allocates memory at compile time.
- It is a finite collection of similar elements.

→ The first element of the array is stored at index '0' and last element at index 'size-1' where size indicates the max^m no. of elements that can be stored inside the array.

→ Each element of an array is of same data type and carries the same size i.e. int = 2 bytes, double = 8 bytes.

→ Elements of the array can be randomly accessed by using its index no.

* Types of array (subscript variable) -

i) Single dimension array -

A list of similar data type elements share a common name and storage class using single subscript is called single dimension array.

ii) Double dimension array - (Multidimensional array) -

A list of similar data type elements share a common name and storage class using more than one subscript is called multidimensional array.

Syntax

- * To declare single dimension array -
`<storage class> datatype array name [array size];`
- * Array declaration and initialization -
`<storage class> data type array name [array size] =
{ value 1, value 2 --- }`