

Topic to discuss

- ① What is data structure?
- ② Abstract data Type.

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1) What is data structure ?

- What is data ?
- Variables
- Memory or computer computer.
- Data types
- Data Structure.

Data : Data is the collection of facts or informations.

This collection can be numbers, alphabets, tables, photos, videos etc.

Variables : In computer science programming we need something for holding data, and variables is the way to do that.

$$x + y = 1 \quad \text{--- (i)} \quad \times 2 \quad 2x + 2y = 2$$

$$2x + 3y = 10 \quad \text{--- (ii)}$$

$$\begin{array}{r} 2x + 2y = 2 \\ - 2x + 3y = 10 \\ \hline \end{array}$$

$$-y = -8$$

$$\therefore y = 8$$

$$x = -7$$

$$y = 8$$

$$x + y = 1$$

$$x = 1 - y$$

$$= 1 - 8$$

$$= -7$$

Memory or computer memory :

computer memory used to store data or information or instructions. It is a data storage unit or a data storage device where data is to be processed and instructions required for processing are stored.

Computer memory is of three basic types:

- 1) Primary memory (RAM and ROM)
- 2) Secondary memory (Hard drive, CD etc).
- 3) Cache memory

Data Types :

Data types are the type of data stored in a program. They are expressed in the language syntax in form of declarations for variables.

A data type in a programming language is a set of data with predefined values.

There are two types of data types:

- a) System-defined data types (Primitive data type)
- b) User-defined data types.

a) System-defined data types (Primitive data type)

Data types that are defined by system are called primitive data types.

The primitive data types provided by many programming languages are `int`, `float`, `char`, `double`, `bool` etc.

`int` = 4 byte / 2 byte
`float` = 4 byte
`char` = 1 byte / 2 byte
`double` = 8 byte
`long` = 8 byte
`bool` = 2 byte.

A byte is a unit of data.

A byte considered as a unit of memory size.

1 byte = 8 bit

1 Kilo byte (KB) = 1024 bytes

1 Mega byte (MB) = 1024 KB

1 Giga byte (GB) = 1024 MB

1 Tera byte (TB) = 1024 GB

(b) User-defined data types :

If the system-defined data types are not enough, then most programming languages allow the users to define their own data types, called user-defined data types.

eg:- structures in C/C++ , classes in java.

Data Structure :

Data structure is a particular way of storing and organizing data in a computer so that it can be used efficiently.

A data structure is a special format for organizing and storing data.

Eg: Array, linked list, stack, queue, trees, graphs etc.

Depending on the organization of the elements, data structures are classified into two types:

- 1) Linear data structure.
- 2) Non-Linear data structure.

Linear data structure :

Elements are accessed in a sequential order but it is not compulsory to store all elements sequentially (say Linked Lists).

Eg. : Linked Lists , Stacks , Queues.

Non-linear data structure :

Elements of this data structure are stored or accessed in a non-linear order.

Eg. : Trees and graphs

2) Abstract Data Types (ADT)

Primitive data types support basic operations such as addition or subtraction etc. The system provides the implementations for the primitive data types.

For user-defined data types we also need to define operations. The implementation of these operations can be done when we want to actually use them.

To simplify the process of solving problems, we combine the data structures with their operations and we call this Abstract data types (ADT).

An Abstract data type consists of two parts:

1. Declaration of data.
2. Declaration of operations.

Abstract data type (ADT) is a type (or class) for objects whose behavior is defined by a set of operations.

The definitions of ADT only mentions what operations are to be performed but not how these operations will be implemented. It does not specify how data will be organized in memory and what algorithm will be used for implementing the operations. It is called Abstract data type because it gives an implementation - independent view.

for example, stack uses a LIFO mechanism while storing the data in data structure.

common operations are: creating the stack,
push, pop.

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