# What is Data Structure: Types, Classifications and Applications?

Data is one of the most powerful tools available to any business or organization that wants to not only survive but rise to the top in today's competitive and challenging world. The more information available, the more options and better solutions to problems and obstacles open up.

However, this data brings some hefty demands, including a need to keep the information organized and easily accessible. All the data in the world won't help a business if it can't reach the data and turn it into an actionable asset.

Related learning: Data Structures and Algorithms Tutorial

This dilemma brings us to the answer of a common question — What is data structure? This article will define data structures, explore the different types of data structures, data structure classification, and how data structures are applied. We'll even delve into concepts like the linear data structure and the nonlinear data structure. We'll cover resources like data structure interview questions, perfect for people applying for a related position.

Let's dive right into the world of data structures and algorithms

## Well, What is Data Structure, Anyway?

Before defining data structures, let's back up a little and ask, "What is data?" Here's a quick answer: Data is information optimized for processing and movement, facts and figures stored on computers.

Data structures are a specific way of organizing data in a specialized format on a computer so that the information can be organized, processed, stored, and retrieved quickly and effectively. They are a means of handling information, rendering the data for easy use.

Every application, piece of software, or programs foundation consists of two components: algorithms and data. Data is information, and algorithms are rules and instructions that turn the data into something useful to programming.

Put another way, remember these two simple equations:

Related data + Permissible operations on the data = Data Structures

Data structures + Algorithms = Programs

Related learning: What Is An Algorithm? Characteristics, Types and How to write it

Related learning: Breadth-First Search Algorithm

## Characteristics of Data Structures

Data Structure is the systematic way used to organise the data. The characteristics of Data Structures are:

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## Characteristics of Data Structures

Data Structure is the systematic way used to organise the data. The characteristics of Data Structures are:

### Linear or Non-Linear

This characteristic arranges the data in sequential order, such as arrays, graphs etc.

### Static and Dynamic

Static data structures have fixed formats and sizes along with memory locations. The static characteristic shows the compilation of the data.

### Time Complexity

The time factor should be very punctual. The running time or the execution time of a program should be limited. The running time should be as less as possible. The less the running time, the more accurate the device is.

### Correctness

Each data must definitely have an interface. Interface depicts the set of data structures. Data Structure should be implemented accurately in the interface.

### Space Complexity

The Space in the device should be managed carefully. The memory usage should be used properly. The space should be less occupied, which indicates the proper function of the device.

## Linear Data Structures

Data elements in a linear data structure are linked to one another in a sequential arrangement, with each element linked to the elements in front of and behind it. In this manner, a single run can traverse the structure. Linear data structures consist of four types. They are:

- Stack
- Array
- Queue
- Linked list

### Stack

### Stack

The linear data structure stores the data elements in the 'first-in/ last-out' or the 'last-in/ first out' order. These orders are known as FILO and LIFO orders, respectively. By using Stack, the element can be added and removed simultaneously from the same end. In Python, Stack can be developed in the following ways.

1. Queue.LifoQueue
2. List
3. Collections.deque

In Stack, the terms 'Push' and 'Pop' are used instead of 'insert' and 'delete'.

### Array

It is the collection of similar data types that are stored in the Contiguous Memory Locations. Arrays are used in Python as well. Arrays work on the scale of 0 to (n-1), where 'n' denotes the size of the array. Arrays are of two types. They are:

1. One-dimensional Array
2. Multi-dimensional Array

### Queue

The queue is a linear data structure that follows the FIFO order. FIFO stands for First In and First Out. The order is that the elements which are inserted first are to be removed first. The properties of Queue data structure are:

1. Inserting an element
2. Deleting the element
3. Time of access.

### Linked List

Linked Lists separate the data structures that are stored consecutively. The last node of a data structure will be linked to the first node of the next data structure. The first element of any data structure is known as the Head of the List. The linked list helps in memory allocation, stores data in internal structure etc. There are three types of Linked Lists. They are:

1. Single Linked List
2. Double Linked List
3. Circular Linked List

## Non-Linear Data Structures

The data structure in which the data elements are randomly arranged. The elements are non-arranged sequentially. The data elements are present at different levels. In Non-linear data structures, there are different paths for an element to reach the other element. The data elements in the non-linear data structures are connected to one or more elements. There are two types of non-linear data structures. They are:

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- Tree Data Structure
- Graph Data Structure

### Tree Data Structure

Tree data structures are completely different from the arrays, stacks, queues and linked lists. Tree data structures are hierarchic. The tree data structure collects the nodes together to depict and stimulate the sequence. Tree data structure does not store the data sequentially. It stores the data on multiple levels. The top node of the Tree Data Structure is known as the Root Node. Any type of data can be stored in the root node. Each node shall definitely contain the data. The branches in the Tree Data Structure are known as the children.

The different parts of the Tree Data Structure are:

1. Root Node
2. Child Node
3. Edge
4. Siblings
5. Leaf Node
6. Internal Nodes
7. Height of the tree
8. Degree of the Node

### Graph Data Structure

In Graph Data Structure, one node is simply connected to the other node through the edge of the graph. The Graph Data Structure obviously uses Non-linear data structures which are not sequentially arranged. The graph data structures consist of edges and nodes represented by E and V, respectively. Graph Data Structures do not have root nodes. It does not have a standard order of arranging the data. Every tree is also known as the graph with n-1 edges where 'n' represents the total number of vertices in the graph. There are various categories in the graphs such as undirected, unweighted, directed and weighted.

The different parts of the graph are as follows.

1. Vertex

2. Edges
3. Directed Edge
4. Undirected Edge
5. Weighted Edge
6. Degree
7. Indegree
8. Outdegree

## Data Types

Data types are the basic elements in the classification of the data. Data types are used in the transmission of information between the programmer and the compiler. There are different data types. They are as follows.

### Boolean:

In computer programs, there are three types of data such as numbers, text and booleans. Boolean is a data type, and the value in the boolean can be either false or true or positive or negative. A boolean type of data proves whether the data is valid or invalid. Boolean values have two possible states such as True or False. In the binary system, the values 0 and 1 are used. Boolean expressions deal with algebra, logical values and binary variables.

### Integer:

The integer data type stores both positive numbers and negative numbers along with zero. The integer data type uses all these integers to maintain precision. All the arithmetic operations can be efficiently done through integer data types. If the value of data is beyond the numerical range of the integer then it is the case that the database server cannot store the value. However, integer data type consumes four(4) bytes of storage per value.

### Floating-Point Numbers

A floating-point data type approximates real values using a formula in order to allow a trade-off between range and precision. Due to the need for quick processing speeds, systems with extremely small and very large real numbers are frequently found to use floating-point calculation. An exponent in a fixed base is typically used to scale a number and approximate its representation to a specific number of significant digits.

### Fixed-Point Numbers

Binary words are used to store numbers in digital electronics. A fixed-length string of bits (1s and 0s) is a binary word. The data type determines how these 1s and 0s are interpreted by hardware elements and software processes. There are two different data types for binary numbers: fixed-point and floating-point. Both signed and unsigned fixed-point data formats are available. There is no sign bit. Therefore the binary word does not typically explicitly express whether a fixed-point value is signed or unsigned. In contrast, the architecture of the computer implicitly defines the sign information.

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### Character

Character information is stored in a fixed-length field by the CHAR data type. Data can be a string of letters, integers, and other characters that are supported by the code set of your database locale, whether they are single-byte or multibyte characters.

Strings with a fixed length or a variable length can be used to hold character data. Variable-length strings are not extended; fixed-length strings are right-extended with spaces on output.

### Pointers

Blocks of memory that are dynamically allocated are managed and stored using pointers. Data objects or arrays of objects are stored in such alliances. The heap or free store, which is a memory space provided by the majority of structured and object-oriented languages, is where objects are dynamically allocated.

### String

A string data type consists of a series of characters, either in the form of a literal constant or a variable. The latter can either be constant in length or allow its elements to alter (after creation). An array data structure of bytes (or words) is frequently used to create a string, which is typically thought of as a sort of data and contains a succession of items, typically characters, using some kind of character encoding.

## How Are Data Structures Used?

Implementing the physical representations of abstract data types uses data structures. When creating effective software, data structures are a key component. They are also essential to the design of algorithms and the use of those algorithms in software. The data structures are used in different asp[illegible]as,

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### Storing Data

When providing the set of attributes and matching structures that will be used to store records in a database management system, data structures are utilised to efficiently persist data.

### Managing Resources and Services

Data structures, including linked lists for memory allocation, file directory management and file structure trees, as well as process scheduling queues, are used to allow core operating system (OS) resources and functions.

### Data Exchange

Information shared across applications, such as TCP/IP packets, is organised using data structures.

### Ordering and Sorting

Binary search trees, sometimes referred to as ordered or sorted binary trees, are data structures that offer practical ways to sort things, such as character strings used as tags. Programmers can control objects arranged in a given priority using data structures like priority queues.

### Indexing

To index items, such as those kept in a database, even more complex data structures like B-trees are utilised.

### Searching

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### Scalability

Data structures are used by big data applications to allocate and manage data storage across distributed storage sites, assuring performance and scalability. To make querying easier, several big data programming environments, like Apache Spark, offer data structures that replicate the fundamental structure of database entries.

## Choosing a Data Structure

The steps to be used in choosing the data structure are given below.

1) The first step in determining the basic operations that must be supported is to analyse the problem. Inserting a data item into the data structure, deleting a data item from the data structure, and finding a specific data item are examples of basic operations.

2)Identify the resource constraints for each operation and quantify them.

3) Determine which data structure best meets these requirements.

### Supported Operations:

If the underlying data type of an attribute can be translated into one of the kinds for which an operation is supported, processes between the data types not included in the table can be carried out. Data can have numbers added or subtracted from them. The number of days to be added or removed is represented by integers.

For instance, since IEG INT8 is turned into IEG DOUBLE and the addition of IEG DOUBLE and IEG MONEY is supported, the addition of IEG INT8 and IEG MONEY is possible.

### Computational Complexity:

Computational complexity is a metric for how much time and memory (resources) a specific algorithm uses when it is executed. Before developing the code, computer scientists can forecast an algorithm's execution time and memory needs using mathematical metrics of complexity. For programmers implementing and choosing algorithms for practical applications, these predictions are essential guides.

### Programming Elegance:

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### Programming Elegance:

One of those things that are simple to recognise but difficult to define is an elegant programme. It uses words effectively without resorting to obfuscation. It is succinct without employing complicated code. It strikes a balance between the concepts of simplicity and explicitness, coding complexity while staying superficial to read and understand. Writing the coding equivalent of flawless writing is every programmer's ultimate ambition.

There is no "magic solution" or one solution to this issue. Coding standards can be used to aid, but they must be founded on a solid framework that ensures the core of the matter is conveyed to the programmer and reflected in the code.

## Data Types and Their Relationship With Data Structures

To answer the question of what is data structure, there are three basic data types to understand.

### Abstract.

Abstract data is defined by how it behaves. This type encompasses graphs, queues, stacks, and sets.

### Composite (or Compound).

Composite data comprises combined primitive data types and includes arrays, classes, records, strings, and structs. They may also consist of other composite types.

### Primitive.

Primitive data is classified as basic data and consists of Boolean, characters, integers, pointers, and fixed- and floating-point numbers.

These data types are the building blocks of data structures. Data types tell the interpreter or the computer how the programmer plans on using the data. Furthermore, data analysts can choose from different data structure classifications. The trick is to select the structure best suited for your needs and situation.

## What Are the Classifications of Data Structure?

What is data structure? Good question! It has so many definitions and characteristics, it's easy to get confused and overwhelmed with the terminology. There are different types and classifications of data structures and the data itself, as we've just seen. This volume of information brings even more questions. What is a linked list? What is a linear data structure? What is data structure???!!

Let's try to make sense of data structures by looking at the classifications. There are three main data structure classifications, each consisting of a pair of characteristics.

### Linear and Nonlinear.

Linear structures arrange data in a linear sequence, such as found in an array, list, or queue. In nonlinear structures, the data doesn't form a sequence but instead connects to two or more information items, like in a tree or graph.

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### Static and Dynamic.

As the term implies, static structures consist of fixed, permanent structures and sizes at compile time. The array reserves a set amount of reserve memory set up by the programmer ahead of time. Dynamic structures feature non-fixed memory capacities, shrinking or expanding as required by the program and its execution requirements. Additionally, the location of the associated memory can change.

### Homogenous and Non-Homogenous.

Homogenous data structures consist of the same data element type, like element collections found in an array. In non-homogenous structures, the data don't have to be the same type, such as structures.

## Linear Vs Non-linear Data Structures

| Parameter | Linear Data Structure | Non-linear Data Structure |
|---|---|---|
| Arrangement of the data elements | In the case of a linear data structure, the data items are stored in a linear order. Every element is linked to the first and next elements in the sequence. | In the case of a non-linear data structure, the data pieces are ordered non-linearly and attached hierarchically. The data elements are linked to several items. |

| | | |
|---|---|---|
| Categories | A linear data structure can be an array, a stack, a linked list, or a queue. | Non-linear data structures include trees and graphs. |
| Levels | The linear data structure consists of a single level. It has no hierarchy. | There are several layers involved in this arrangement. As a result, the elements are organized hierarchically. |
| Traversal | Because linear data has only one level, traversing each data item needs only one run. | non-linear data structure data elements cannot be retrieved in a single run. It is necessary to traverse many runs. |
| Memory usages | Memory use is inefficient in this case. | Memory is used very efficiently in this case. |
| Applications | Linear data structures are mostly utilized in software development. | Image processing and artificial intelligence both make use of non-linear data structures. |
| Time Complexity | The time complexity of a linear data structure grows as the input size grows. | The time complexity of a non-linear data structure frequently remains constant as the input size increases. |
| Relationships | Only one form of relationship between the data pieces is possible. | A non-linear data structure can have a one-to-one or one-to-many connection between its pieces. |

## The Different Data Structure Types

So far, we have touched on data types and data structure classifications. Our walk through the many elements of data structures continues with a look at the different types of data structures.

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### Array.

Arrays are collections of data items that are of the same type, stored together in adjoining memory locations. Each data item is known as an "element." Arrays are the most basic, fundamental data structure. Aspiring Data Scientists should master array construction before moving on to other structures such as queues or stacks.

### Graphs.

Graphs are a nonlinear pictorial representation of element sets. Graphs consist of finite node sets, also called vertices, connected by links, alternately called edges. Trees, mentioned below, are a graph variation, except the latter has no rules governing how the nodes connect.

### Hash Tables.

Hash tables, also called hash maps, can be used as either a linear or nonlinear data structure, though they favor the former. This structure is normally built using arrays. Hash tables map keys to values. For example, every book in a library has a unique number assigned to it that facilitates looking up information about the book, like who has checked it out, its current availability, etc. The books in the library are hashed to a unique number.

### Linked List.

Linked lists store item collections in a linear order. Each element in a linked list contains a data item and a link, or reference, to the subsequent item on the same list.

### Stack.

Stacks store collections of items in a linear order and are used when applying the operations. For example, the order could be "first in, first out" (FIFO) or "last in, first out" (LIFO).

### Queue.

Queues store item collections sequentially like stacks, but the operation order must be "first in, first out" only. Queues are linear lists.

Also Read: Queue Implementation Using Array

### Tree.

Trees store item collections in an abstract hierarchy. They are multilevel data structures that use nodes. The bottom nodes are called “leaf nodes,” while the topmost node is known as the “root node.” Each node has pointers that point to adjacent nodes.

### Trie.

Not to be confused with a Tree, Tries are data structures that store strings like data items and are placed in a visual graph. Tries are also called keyword trees or prefix trees. Whenever you use a search engine and receive autosuggestions, you’re witnessing the trie data structure in action.

## Types of Trees in Data structure

### General Tree

A tree is considered a general tree if its hierarchy is not constrained. There is no limit on the number of children that a node can have in the General Tree. All other trees are subsets of the tree.

### Binary Tree

A binary tree is a sort of tree data structure in which each parent node has no more than two child nodes. As the name implies, binary means two, therefore each node might have zero, one, or two nodes. The popularity of this tree is higher than that of most others. A Binary tree may be modified to accommodate certain limitations and features, such as by using the AVL tree, the BST tree, the RBT tree, and others. We will go through all of these styles in depth as we progress.

### Binary Search Tree

These tree data structures are non-linear, with one node connecting to several others. At most two child nodes can be attached to the node. A binary search tree is so named because:

1. Each node can have up to two child nodes.
2. It may be utilized to search for an element in 0(log(n)) time and is hence referred to as a search tree.

### AVL Tree

The AVL tree is a self-balancing binary search tree. Adelson-Velshi and Landis are the inventors behind the term AVL. Dynamically balanced trees were first created here. Based on whether the AVL tree is balanced or not, each node is assigned a balancing factor. The node kids have a maximum height of one AVL vine. The right balance factors in the AVL tree are 1, 0, and -1. If a new node is added to the tree, it will be rotated to ensure that it is balanced. Then it will be rotated. In the AVL tree, common operations like viewing, insertion, and removal require O(log n) time. It is usually used while doing Lookups activities.

### B Tree

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A B Tree is a more generic binary search tree. A height-balanced m way tree refers to this type of tree, where m denotes the order of the tree. Each tree node can have multiple keys and more than two child nodes. The leaf nodes of a binary tree may not be at the same level. It is important that all leaf nodes in a B Tree be equal in height.

## Types of Graphs

### The Null Graph

The order zero graphs is another name for the Null Graph. A graph with an empty edge set is referred to as a "null graph." As the name implies, a null graph has 0 edges and consists only of isolated vertices.

### Trivial Graph

If a graph contains only one vertex, it is called a trivial graph. One vertex is all that is needed to construct the trivial graph, which is the smallest possible graph.

### The Finite Graph

If the number of vertices and edges in the graph is restricted, the graph is termed a finite graph.

### Infinite Graph

If the number of vertices and edges in the graph is infinite, the graph is called finite.

### Graph With Directions

Digraphs is another term for directed graphs. A graph is called a directed graph or digraph if all of the edges connecting any of its vertices or nodes are directed or have a definite direction. By directed edges, we mean graph edges that have a direction to indicate where they begin and where they stop.

### Simple Graph

Every pair of nodes or vertices in a simple graph has just one edge connecting them. As a consequence, only one edge connects two vertices, illustrating one-to-one interactions between two components.

### Multiple Graphs

When there are many edges connecting two vertices in a graph G= (V, E), the graph is called a multigraph. A Multigraph has no self-loops.

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## Complete Graph

A graph is complete if it is a simple graph. Edges having an n number of vertices must be linked. It is also known as a complete graph since the degree of each vertex must be n-1.

## Pseudo Graph

A pseudograph is one that has a self-loop in addition to other edges.

## Regular Graph

A regular graph is one such category of graph type that is a simple graph along with the exact same value of the degree at each of the vertices. As a result, every graph on its whole is a regular graph.

## Bipartite Graph

Bipartite graphs can be divided into two non-empty disjoint parts with the same vertex set. V1(G) and V2(G) so that each edge e of E(G) has one end in V1(G) and the other end in V2(G) (G). Bipartite of G refers to the partition V1 U V2 = V.

## Weighted Graph

A labeled or weighted graph is one with each edge having a value or weight expressing the expense of crossing that edge.

## Connected Graph

The graph is linked if there is a path connecting one vertex of a graph data structure to any other vertex.

## Disconnected Graph

When there is no edge connecting the vertices, the null graph is referred to as a disconnected graph.

## The Cyclic Graph

The graph is linked if there is a path connecting one vertex of a graph data structure to any other vertex.

### Disconnected Graph

When there is no edge connecting the vertices, the null graph is referred to as a disconnected graph.

### The Cyclic Graph

A graph is termed cyclic if it has at least one graph cycle.

### Acyclic Graph

A graph is said to be acyclic if it contains no cycles.

### Acyclic Directed Graph

It is a type of graph data structure which has directed edges but no cycle, and it is also termed a DAG. The full form of DAG is a directed acyclic graph. Because it guides the vertices and maintains certain data, it depicts the edges with an ordered pair of vertices.

### Subgraph

A subgraph is a set of vertices and edges in one graph that are subsets of another.

## Data Structure Operations

The following are the most frequent operations that may be done on data structures:

1. Searching - Searching entails locating a certain piece inside a specified data structure. When the needed ingredient is discovered, it is termed a success. Searching is an operation that may be done on data structures such as arrays, linked lists, trees, graphs, and so on.
2. Sorting - Sorting is the process of ordering all data elements in a data structure in a certain order, such as ascending or descending order.
3. Insertion entails adding new data items to the data structure.
4. The data elements in the data structure can be deleted.
5. Updating - We can update or replace existing data structure parts.

## Characteristics of a Data Structure

Correctness - Data structure implementation should accurately implement its interface.

Time Complexity - The running time or execution time of data structure operations must be as short as feasible.

Space Complexity - A data structure operation should use as little memory as feasible.

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Related learning: Time and Space Complexity in Data Structure

## Execution Time Cases

There are three situations that are commonly used to compare the execution time of various data structures in a relative way.

Worst Case - This is the circumstance in which a specific data structure operation takes the longest time possible.

Average Case - This is a scenario that depicts the average execution time of a data structure action.

Best Case -This is the scenario displaying the shortest feasible execution time of a data structure operation.

## Basic Terminology

Data – Data are values or collections of values.

Data Item - A data item is a single unit of value.

Group Items - They are data items that have been subdivided into sub-items.

Elementary items - Data items that cannot be split are referred to be Elementary Items.

Attribute and Entity - An entity is anything that has attributes or qualities that may be assigned values.

Entity Set - An entity set is made up of entities with comparable properties.

Field - A field is a single elementary unit of information that represents an entity's attribute.

Record - A record is a collection of a specific entity's field values.

File - A file is a collection of records representing the entities in a specific entity set.

## Why Are Data Structures Useful?

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One of the most important things to learn when you seek the answer to your question — what is data structure? Why is data structure useful?

Data structures offer many advantages to IT-related processes, especially as applications get more complex and the amount of existing data keeps growing. Here are some reasons why data structures are essential.

They facilitate greater processing speeds. Large amounts of data require faster processing, and data structures help organize the data into forms that are easier to work with and process.

They make it easier to search for data. Data structures organize information into workable forms that are easier to conduct required searches for.

They are reusable. Once you implement a given data structure, it can be used anywhere. There is no need to make a new structure. This function saves time and resources.

They make it easy to handle multiple requests. You rarely find a single user accessing a database. Instead, it's common to have hundreds, if not thousands, of users searching and interacting with a database. Data structures arrange information so that users don't have to search every item — they can instantly search just the required data.

## What is Data Structure and Its Applications?

Data structures have many applications, such as:

### Data Storage.

Data structures facilitate efficient data persistence, like specifying attribute collections and corresponding structures used in database management systems to store records.

### Data Exchange.

Organized information, defined by data structures, can be shared between applications like TCP/IP packets.

### Resource and Service Management.

Data structures such as linked lists can enable core operating systems resources and services to perform functions like file directory management, memory allocation, and processing scheduling queues.

### Scalability.

File – A file is a collection of records representing the entities in a specific entity set.

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- They make it easier to search for data. Data structures organize information into workable forms that are easier to conduct required searches for.
- They are reusable. Once you implement a given data structure, it can be used anywhere. There is no need to make a new structure. This function saves time and resources.
- They make it easy to handle multiple requests. You rarely find a single user accessing a database. Instead, it's common to have hundreds, if not thousands, of users searching and interacting with a database. Data structures arrange information so that users don't have to search every item — they can instantly search just the required data.

## What is Data Structure and Its Applications?

Data structures have many applications, such as:

### Data Storage.

Data structures facilitate efficient data persistence, like specifying attribute collections and corresponding structures used in database management systems to store records.

### Data Exchange.

Organized information, defined by data structures, can be shared between applications like TCP/IP packets.

### Resource and Service Management.

Data structures such as linked lists can enable core operating systems resources and services to perform functions like file directory management, memory allocation, and processing scheduling queues.

### Scalability.

### Data Exchange.

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### Resource and Service Management.

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### Scalability.

Big data applications rely on data structures to manage and allocate data storage across many distributed storage locations. This function guarantees scalability and high performance.

## Advantages of Data structures

1. Data structure facilitates effective data storage in storage devices.
2. The use of data structures makes it easier to retrieve data from a storage device.
3. The data structure allows for the effective and efficient processing of both little and big amounts of data.
4. Manipulation of vast amounts of data is simple when a proper data structure technique is used.
5. The use of a good data structure may assist a programmer to save a lot of time or processing time while performing tasks such as data storage, retrieval, or processing.
6. Most well-organized data structures, including stacks, arrays, graphs, queues, trees, and linked lists, have well-built and pre-planned approaches for operations such as storage, addition, retrieval, modification, and deletion. The programmer may totally rely on these facts while utilising them.
7. Data structures such as arrays, trees, linked lists, stacks, graphs, and so on are thoroughly verified and proved, so anybody may use them directly without the need for study and development. If you opt to design your own data structure, you may need to do some study, but it will almost certainly be to answer a problem that is more sophisticated than what these can supply.
8. In the long term, data structure utilization might merely encourage reusability.