

# Data Structure and Algorithms

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## Unit- I Introduction (06 Hrs)

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- Introduction to Data Structures: Concept of data, Data object, Data structure, Concept of Primitive and non-primitive, linear and Nonlinear, static and dynamic, persistent and ephemeral data structures
- Definition of ADT, Array: Single and multidimensional array address calculation, recursion.
- Searching and sorting: Need of searching and sorting, Concept of internal and external sorting, sort stability
- Searching methods: Linear and binary search algorithms, Fibonacci Series.
- Sorting methods: Bubble, insertion, Quick, Merge, shell and comparison of all sorting methods.
- Case Studies Set Operation, String Operation

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## Contents

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Section	Contents
DSA Unit-I.1	Introduction to Data Structures, its types
DSA Unit-I.2	Definition of ADT, Array
DSA Unit-I.3	Searching and sorting- Searching
DSA Unit-I.4	<b>Sorting Methods</b>

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## Agenda

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- Data
- Data and Information
- Data Object
- What is Data Structure?
- Organization of Data
- Why to use Data Structure?
- Types of Data Structure
- Data structure operations

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# Outcomes

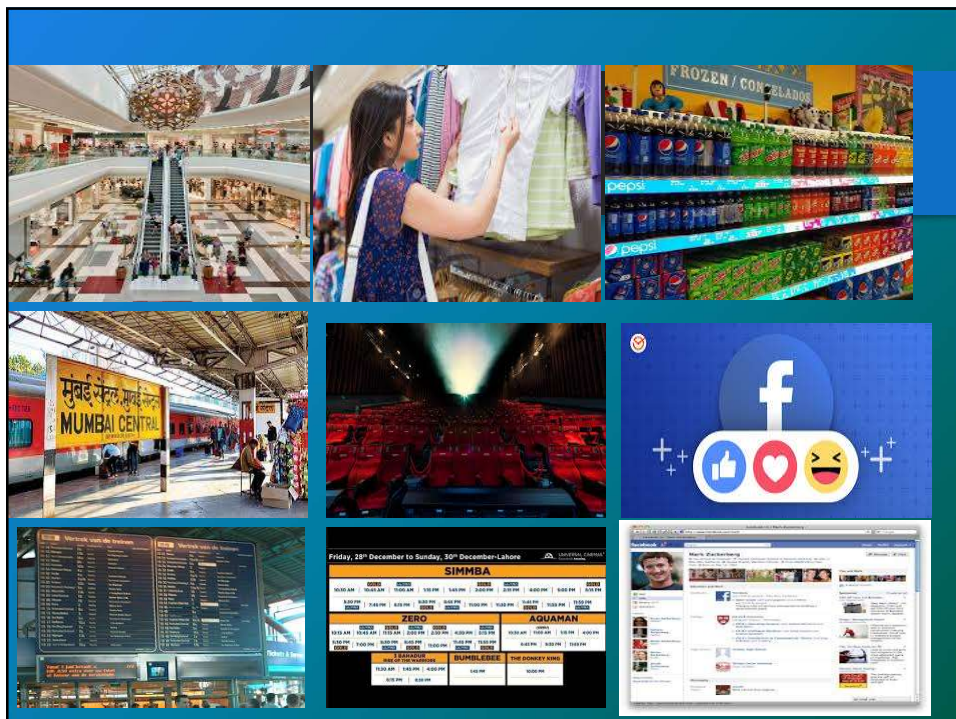
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At the end of this session, students will be able to-

- Define data, Data Object
- Differentiate between data and information
- Define Data Structure
- Understand Data organization and importance of data structure
- List different types of data structures

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# Data

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- Collection of some things which is raw, facts and figures
- Meaningless
- Alphabets, numbers, words, sentences, pictures/photos, audio, video
- If this data is processed, then some meaning/conclusion can be drawn.
- e.g. Data: Temperature 42°C; Conclusion: It's hot
- Types of data
- Textual, numeric, image, audio

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# What is Data?

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Data are characteristics or information, usually numerical, that are collected through observation. In a more technical sense, data is a set of values of **qualitative** or **quantitative variables** about one or more persons or objects, while a **datum** (singular of data) is a single value of a single variable. [Wikipedia]



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By João Batista Neto - Data types - pt br.svg, CC BY 3.0,  
<https://commons.wikimedia.org/w/index.php?curid=43063497>

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## Data & Information

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- “data” = “information” ?
- Data-> **Processing**-> Information
- Information is meaningful and processed form of data
- Computer processes data , draws conclusion, and produce information
- Data is easily available, but information is not.
- Pay for information
- If lost data is difficult to reproduce.

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## Data object

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- Container/ placeholder to store data value
- Can be later used to retrieve value, modify value
- At runtime data object is group of one or more pieces of data, a set of elements, say D, Characterized by set of attributes.
  - E.g. roll number, list of students in a class
  - E.g. data object integers refer to
    - $D=\{0,+-1,+-2...\}$
    - $D=\{'A','B','C'..., 'z'\}$
- D may be finite or infinite
- **Data object** =storage in Computer memory
- Data Value= a pattern of bits.
- In computer science, an object can be a variable, a data structure, a function, or a method, and as such, is a value in memory referenced by an identifier.

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# Data Structures

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- To process data and generate meaningful information, data need to be organized in structured manner.
- E.g. pile of different books, different types of cloth in your wardrobe
- If data is well organized then the task you want to carry out with data will be easy.
- E.g. searching book, selection of kurta for Birthday etc.
- In Computers, Data structures organize data  
     ⇒ produces more efficient programs.
- More powerful computers ⇒ more complex applications.
- More complex applications demand more calculations.
- Complex computing tasks are unlike our everyday experience

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# Organizing Data

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- The collection of records/data organization will help to carry out different tasks.
- Tasks such as searching, processing, modifying , ordering etc.
- Data structure is way of organizing data.
- Algorithm provides way of performing operation on data.
- The choice of data structure and algorithm can make the difference between a program running in a few seconds or many days.

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## Examples of Such Data organizations

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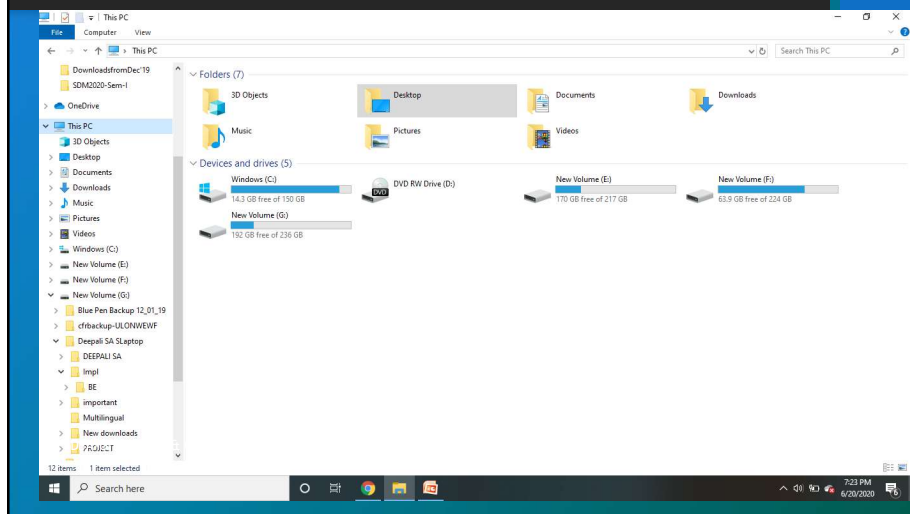
- List out The applications where you have observed structured data organization

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## Example-1

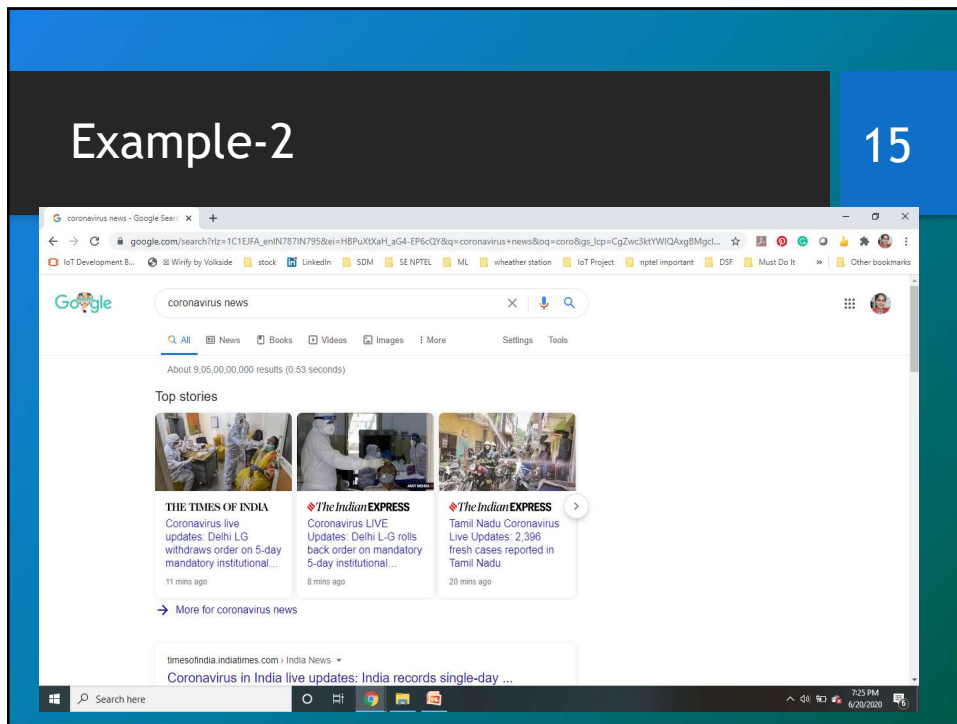
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## Example-2

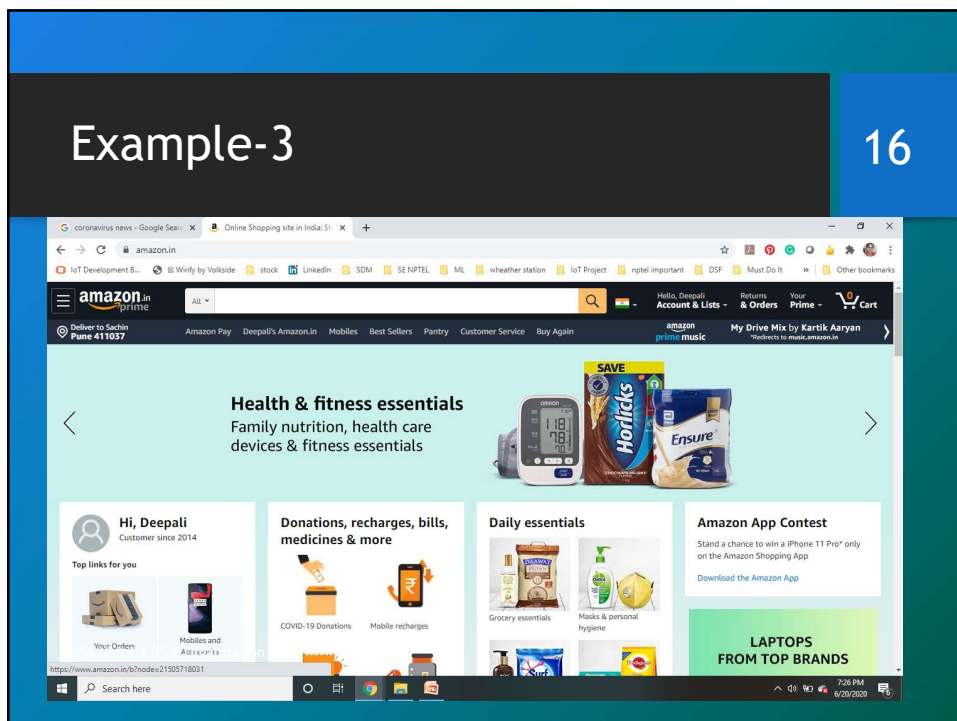
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## Example-3

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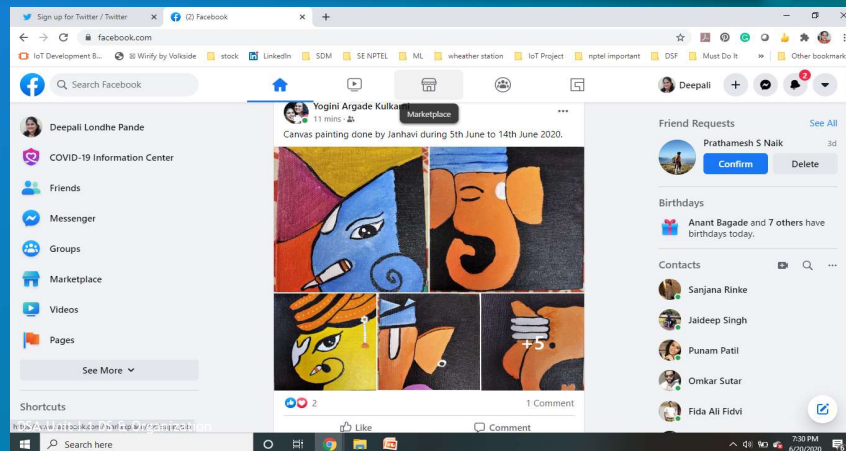


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## Example-4

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## What is data structure?

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- A way of organizing, storing, accessing and updating data is data structure.
- So that it can be used efficiently and effectively.
- E.g. Array, lists, stacks, queues, tree, graphs
- Data structure is the logical or mathematical model of a particular organization of data.
- A group of data elements grouped together under one name.
  - For example, an array of integers

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## Data Structures: Why?

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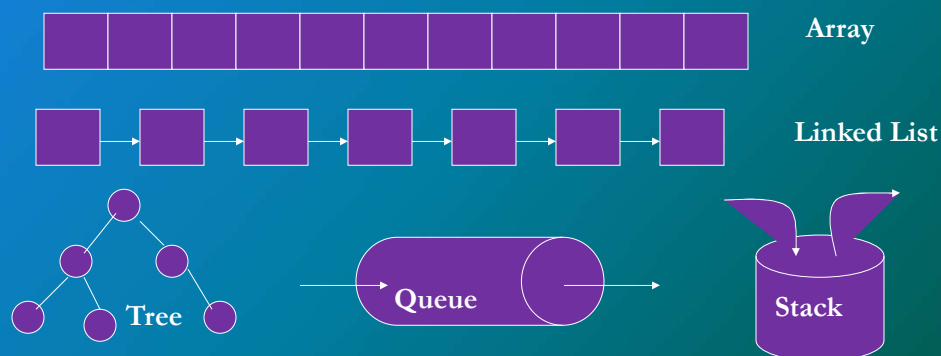
- Program design depends crucially on how data is structured for use by the program
  - Implementation of some operations may become easier or harder
  - Speed of program may dramatically decrease or increase
  - Memory used may increase or decrease
  - Debugging may become easier or harder

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## Types of data structures

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There are many, but we named a few. We'll learn these data structures in great detail!

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## Data Structure Operations

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- Traversing
  - Accessing each data element exactly once so that certain items in the data may be processed
- Searching
  - Finding the location of the data element (key) in the structure
- Insertion
  - Adding a new data element to the structure
- Deletion
  - Removing a data element from the structure
- Sorting
  - Arrange the data elements in a logical order (ascending/descending)
- Merging
  - Combining data elements from two or more data structures into one

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## Different Data Structures

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- Primitive and non-primitive
- Linear and Nonlinear
- Static and dynamic
- Persistent and ephemeral

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## References

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