

Introduction to Data Structure

Basic Terminologies

- Data Structure
 - Data: are simply a value are set of values of different type which is called data types like string, integer, char etc.
 - Structure: Way of organizing information, so that it is easier to use
 - In simple words we can define data structures as
 - Its a way organizing data in such a way so that data can be easier to use.

Basic Terminologies

- Data Structure ..
 - A data structure is a particular way of organizing data in a computer so that it can be used efficiently.
 - A scheme for organizing related pieces of information.

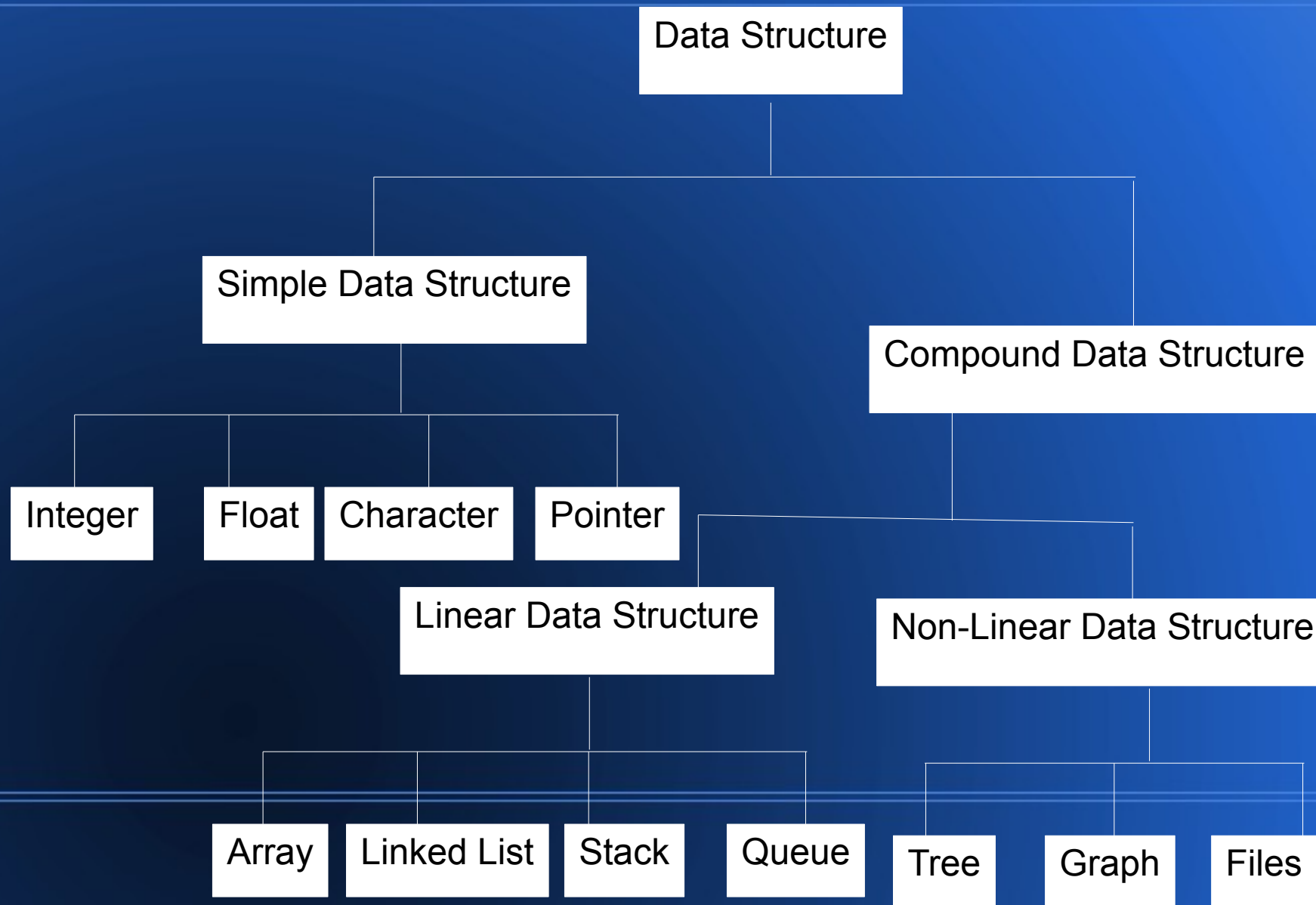
Why Data Structure

- Human requirement with computer are going to complex day by day. To solve the complex requirements in efficient way we need this study.
- Provide fastest solution of human requirements.
- Provide efficient solution of complex problem.
 - Space
 - Time

Study in Data Structure

- Logical or mathematical description of the structure.
- Implementation of structure on a computer using different computer languages (C, C++, JAVA, pl-languages etc.)
- Quantitative analysis of the structure, which includes determining the amount of memory needed to store the structure and the time required to process the structure.

Classification of Data Structure



Classification of Data Structure ...

- **Simple Data Structure:** Simple data structure can be constructed with the help of primitive data structure. A primitive data structure used to represent the standard data types of any one of the computer languages (integer, Character, float etc.).
- **Compound Data Structure:** Compound data structure can be constructed with the help of any one of the primitive data structure and it is having a specific functionality. It can be designed by user. It can be classified as Linear and Non-Linear Data Structure.

Classification of Data Structure ...

- **Linear Data Structures:** A linear data structure traverses the data elements sequentially, in which only one data element can directly be reached. Ex: Arrays, Linked Lists
- **Non-Linear Data Structures:** Every data item is attached to several other data items in a way that is specific for reflecting relationships. The data items are not arranged in a sequential structure. Ex: Trees, Graphs

Operation on Linear/Non-Linear Data Structure

- Add an element
- Delete an element
- Traverse / Display
- Sort the list of elements
- Search for a data element

Types of Data Structure

- Array: is commonly used in computer programming to mean a contiguous block of memory locations, where each memory location stores one fixed-length data item. e.g. Array of Integers `int a[10]`, Array of Character `char b[10]`

Array of Integers

0	1	2	3	4	5	6	7	8	9
5	6	4	3	7	8	9	2	1	2

Array of Character

0	1	2	3	4	5	6	7	8	9
5	6	4	3	7	8	9	2	1	2

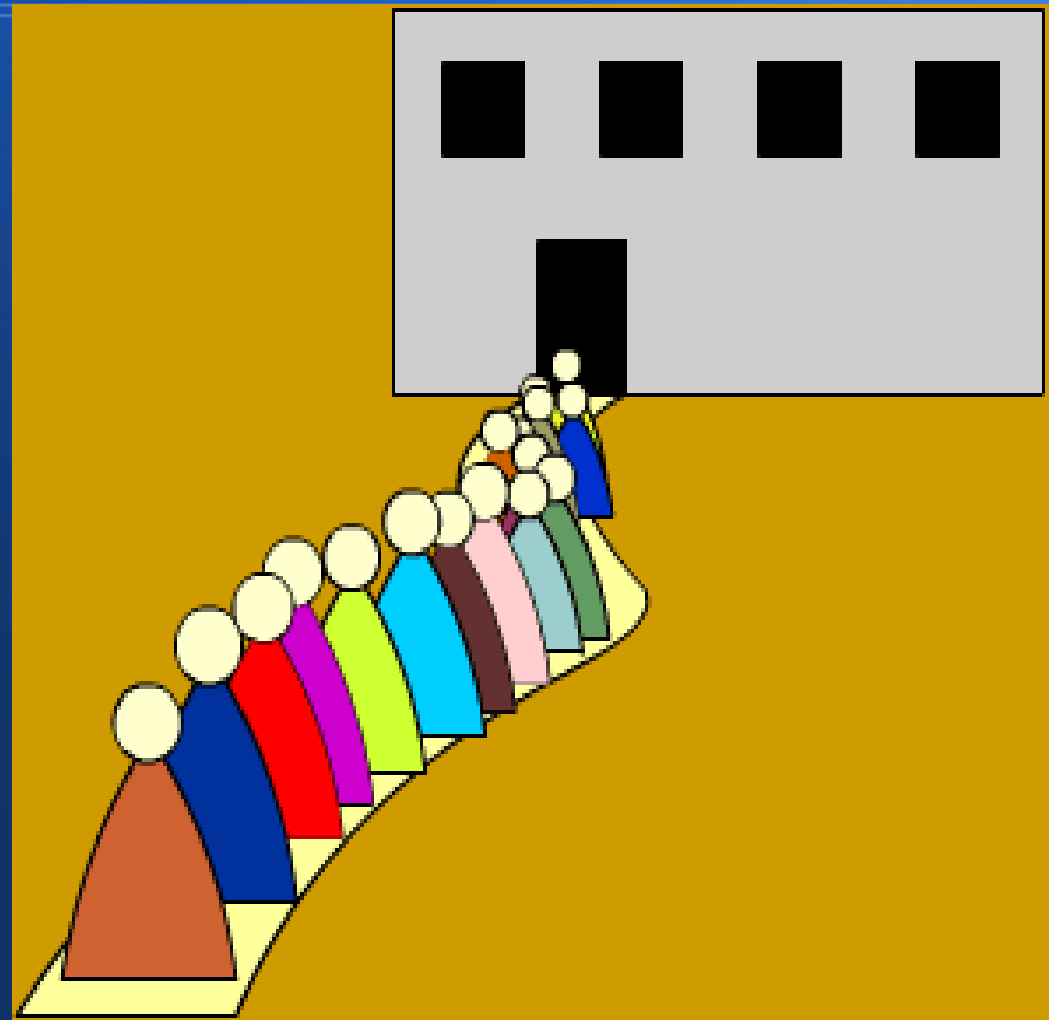
Types of Data Structure ...

Stack: A stack is a data structure in which items can be inserted only from one end and get items back from the same end. There, the last item inserted into stack, is the the first item to be taken out from the stack. In short its also called Last in First out [LIFO].



Types of Data Structure ...

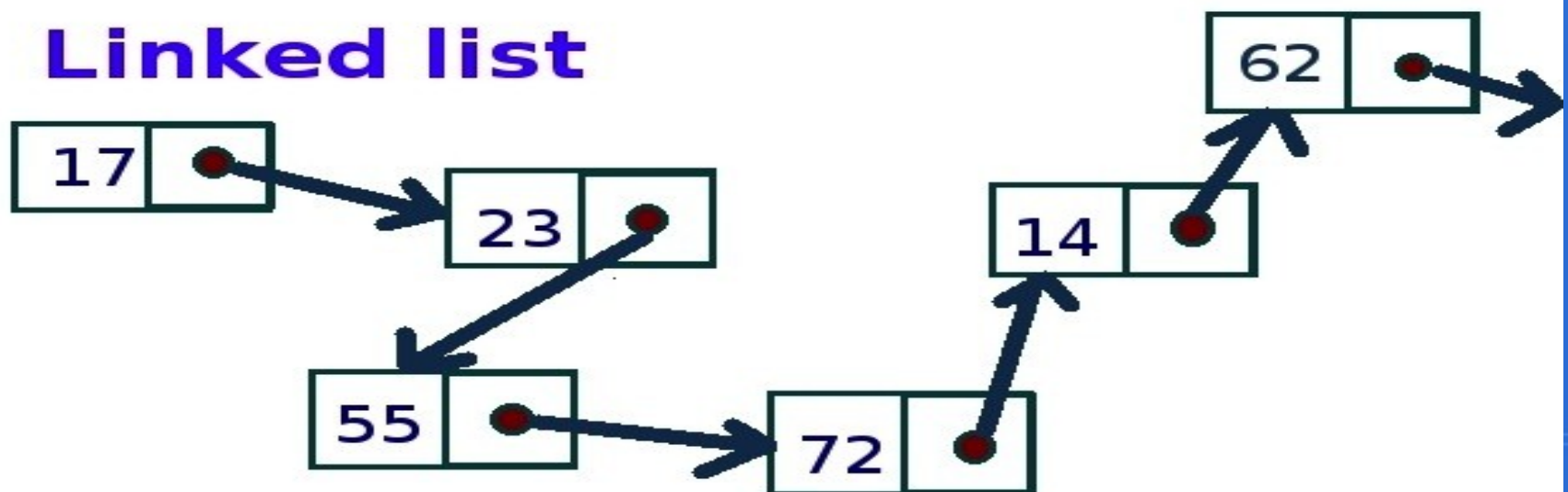
Queue: A queue is two ended data structure in which items can be inserted from one end and taken out from the other end. Therefore , the first item inserted into queue is the first item to be taken out from the queue. This property is called First in First out [FIFO].



Types of Data Structure ...

Linked List: Could alternately used to store items. In linked list space to store items is created as is needed and destroyed when space no longer required to store items. Hence linked list is a dynamic data structure space acquire only when need.

Linked list



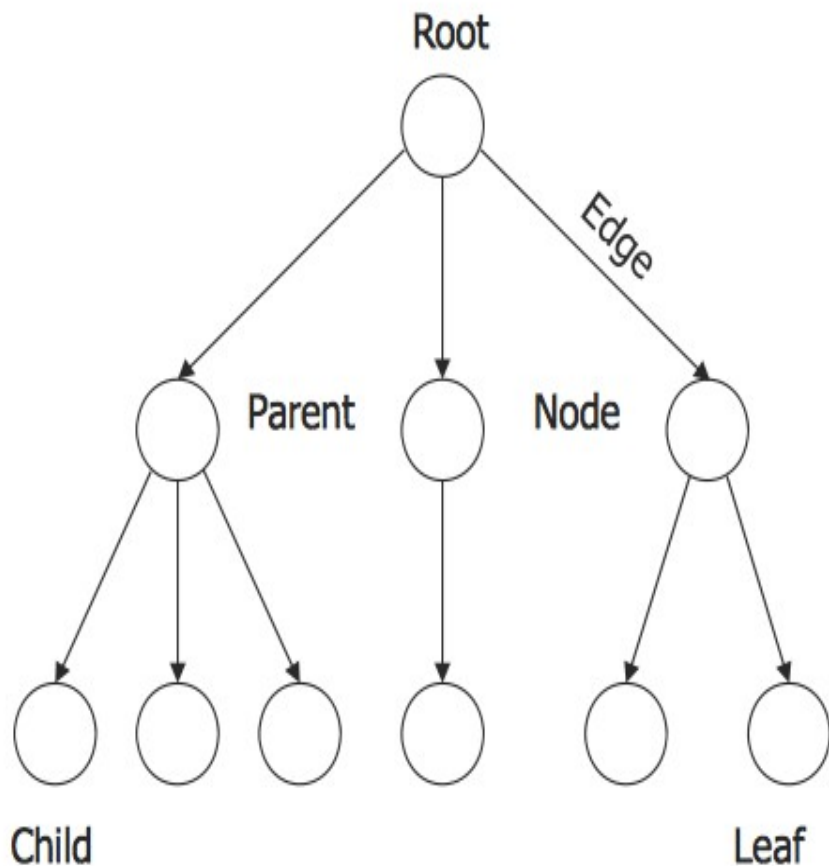
Types of Data Structure ...

Tree: is a non-linear data structure which is mainly used to represent data containing a hierarchical relationship between elements.

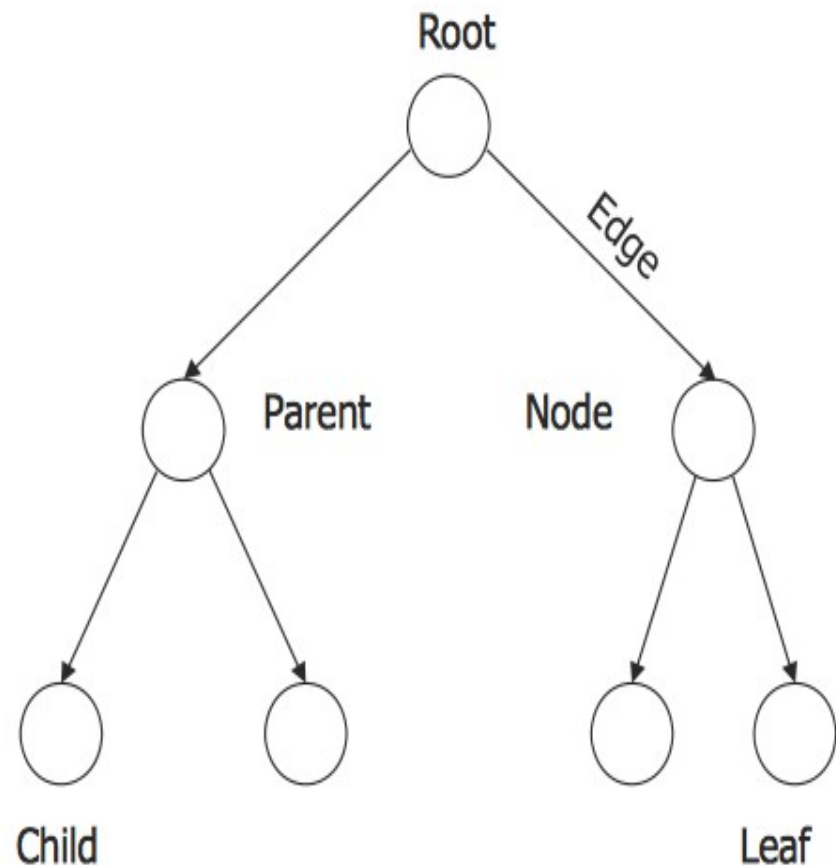
Binary Tree: A binary tree is a tree such that every node has at most 2 child and each node is labeled as either left or right child.

Types of Data Structure ...

■ General tree



■ Binary Tree

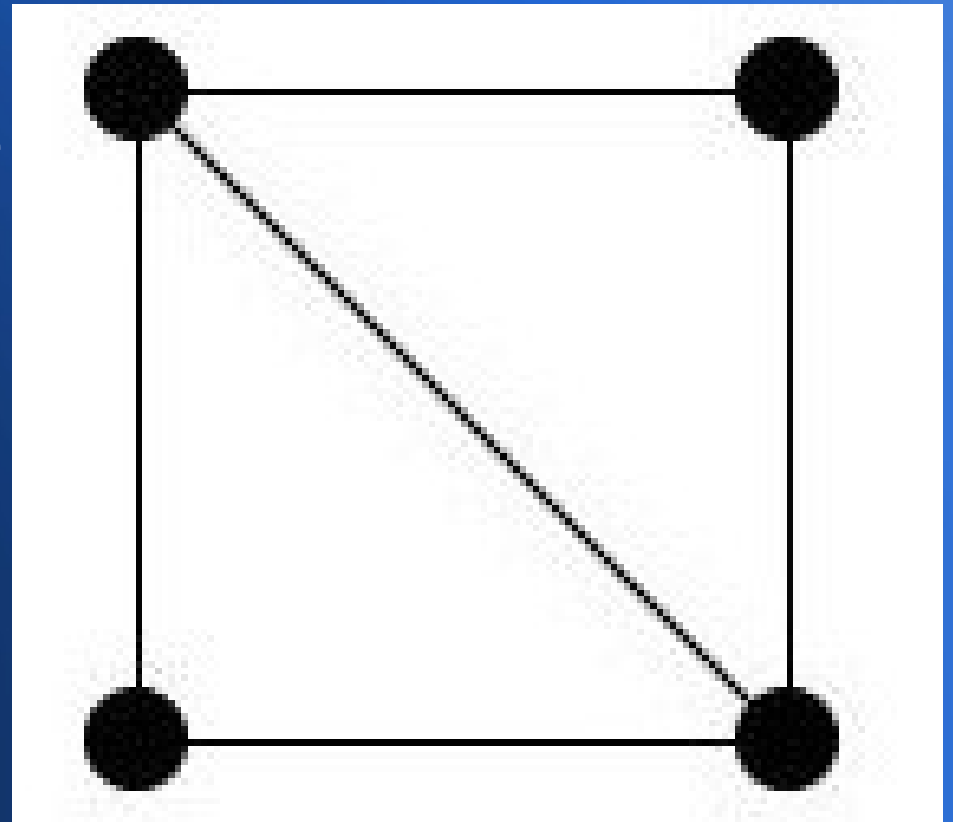


Types of Data Structure ...

Graph: It is a set of items connected by edges. Each item is called a vertex or node. Trees are just like a special kinds of graphs. Graphs are usually represented by $G = (V, E)$, where V is the set vertices and E is the set of Edges.

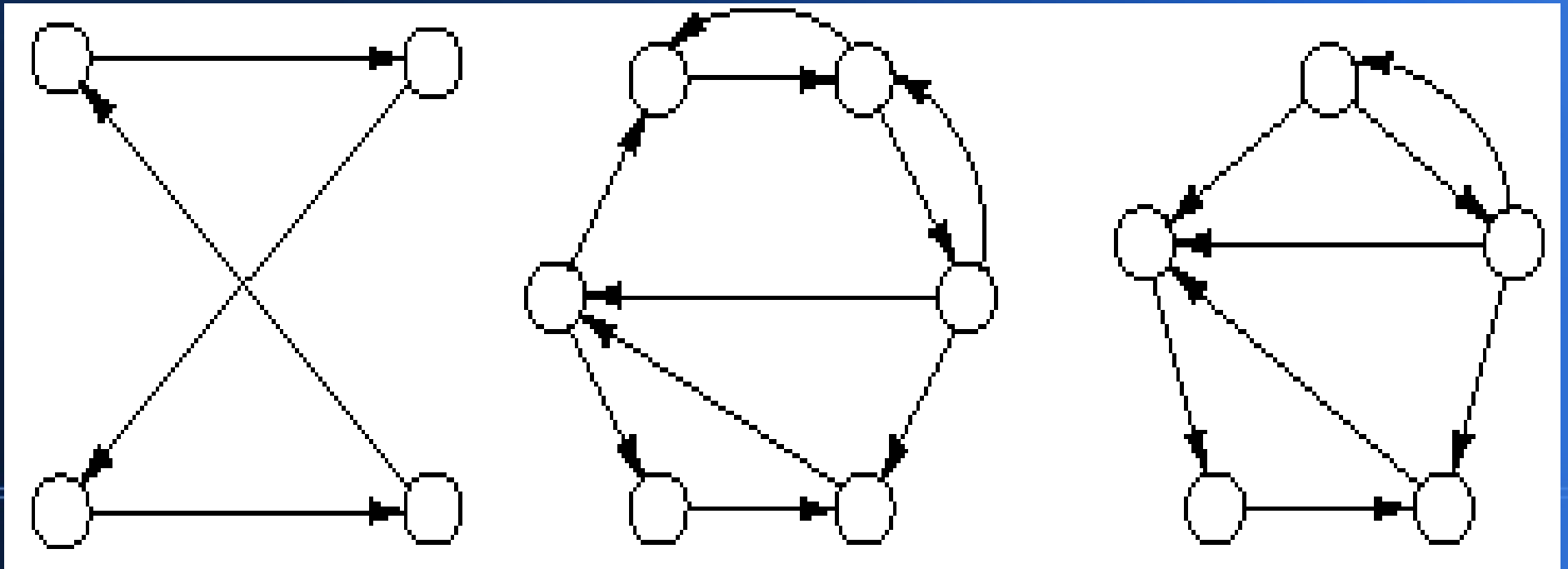
Types of Data Structure ...

Undirected Graph: A graph whose edges are unordered pair of vertices. That is each edge connects two vertices. In an undirected graph, direction is not important, if the path is available, it can be traversed in any direction.



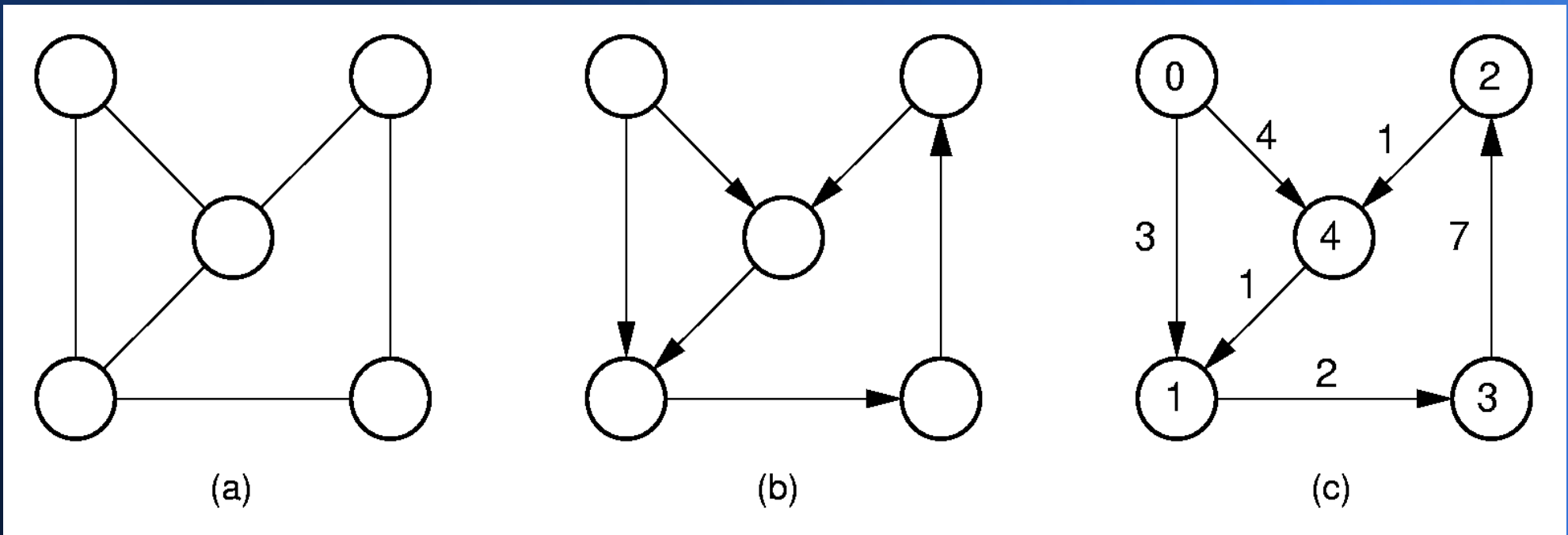
Types of Data Structure ...

Directed Graph: In directed graph a directional edge connect two node/vertex. If there is one edge from one vertex to other then only this path can be followed.



Types of Data Structure ...

Weighted Graph: A graph having a weight, or number associated with each edge



Selecting a Data Structure

- Analyze the problem to determine the resource constraints a solution must meet.
- Determine the basic operations that must be supported. Quantify the resource constraints for each operation.
- Select the data structure that best meets these requirements.