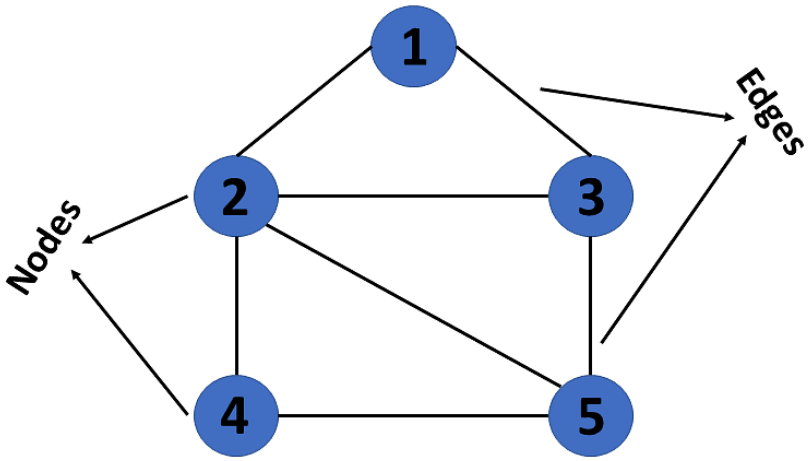
Graph DS

Graphs in data structures are non-linear data structures made up of a finite number of nodes or vertices and the edges that connect them. Graphs in data structures are used to address real-world problems in which it represents the problem area as a network like telephone networks, circuit networks, and social networks. For example, it can represent a single user as nodes or vertices in a telephone network, while the link between them via telephone represents edges.

What Are Graphs in Data Structure?

A graph is a non-linear kind of data structure made up of nodes or vertices and edges. The edges connect any two nodes in the graph, and the nodes are also known as vertices.



This graph has a set of vertices V= { 1,2,3,4,5} and a set of edges E= { (1,2),(1,3),(2,3),(2,4),(2,5),(3,5),(4,50 }.

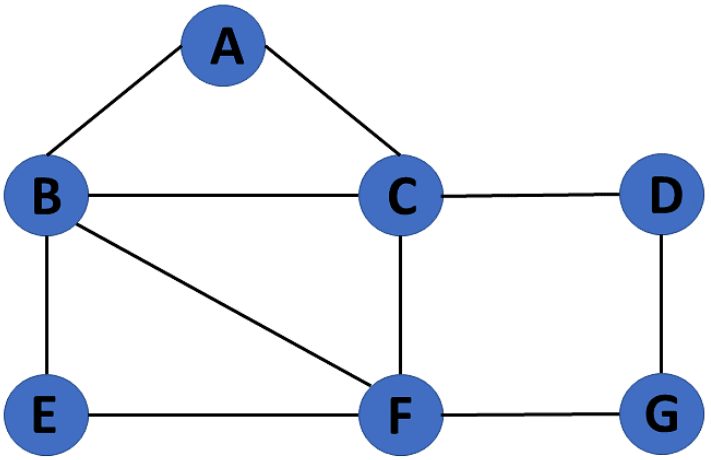
Now that you've learned about the definition of graphs in data structures, you will learn about their various types.

Types of Graphs in Data Structures

There are different types of graphs in data structures, each of which is detailed below.

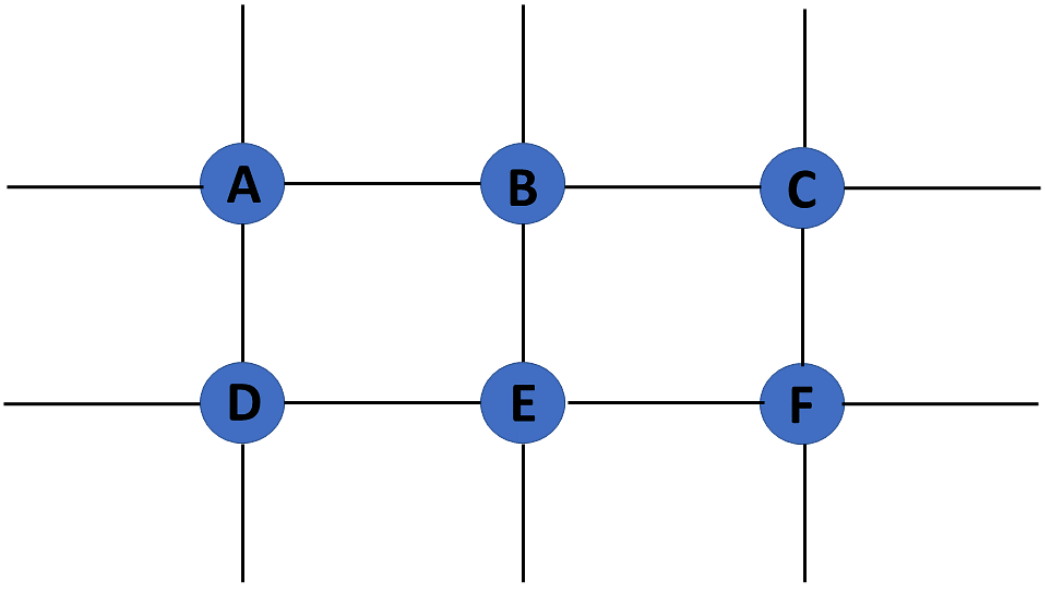
1. Finite Graph

The graph G=(V, E) is called a finite graph if the number of vertices and edges in the graph is limited in number



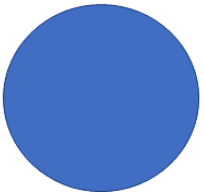
2. Infinite Graph

The graph G=(V, E) is called a finite graph if the number of vertices and edges in the graph is interminable.



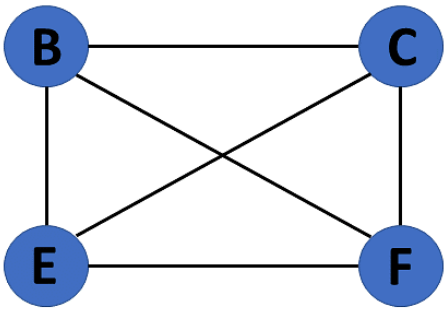
3. Trivial Graph

A graph G= (V, E) is trivial if it contains only a single vertex and no edges.



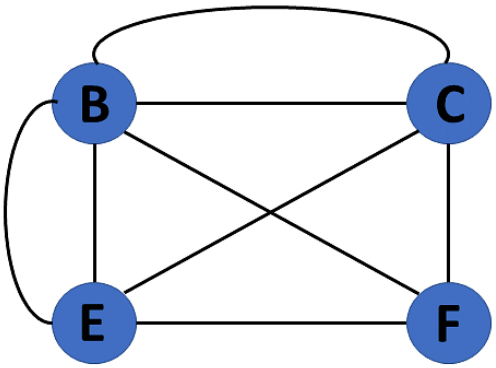
4. Simple Graph

If each pair of nodes or vertices in a graph G=(V, E) has only one edge, it is a simple graph. As a result, there is just one edge linking two vertices, depicting one-to-one interactions between two elements.



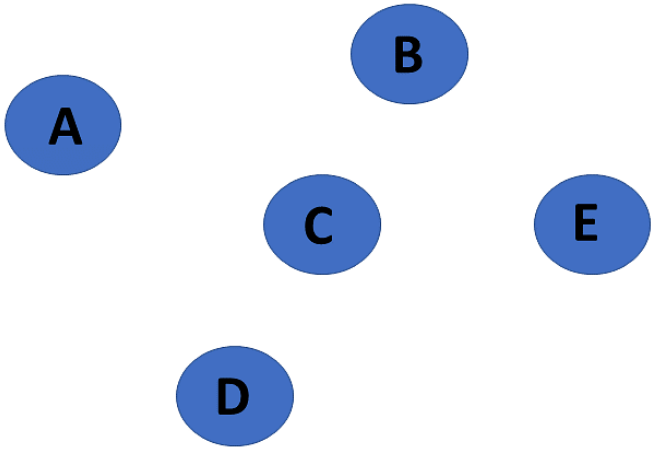
5. Multi Graph

If there are numerous edges between a pair of vertices in a graph G= (V, E), the graph is referred to as a multigraph. There are no self-loops in a Multigraph.



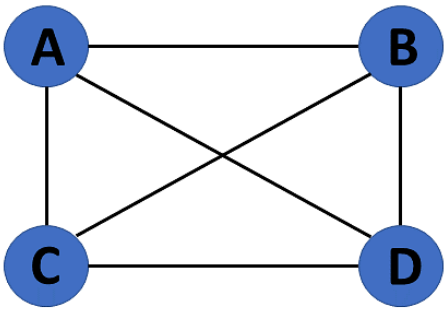
6. Null Graph

It's a reworked version of a trivial graph. If several vertices but no edges connect them, a graph G= (V, E) is a null graph.



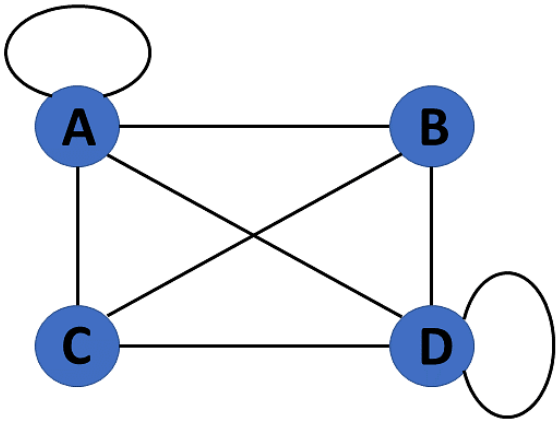
7. Complete Graph

If a graph G= (V, E) is also a simple graph, it is complete. Using the edges, with n number of vertices must be connected. It's also known as a full graph because each vertex's degree must be n-1.



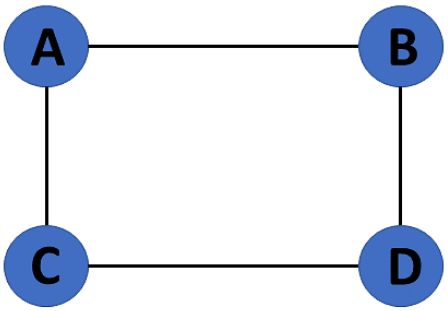
8. Pseudo Graph

If a graph G= (V, E) contains a self-loop besides other edges, it is a pseudograph.



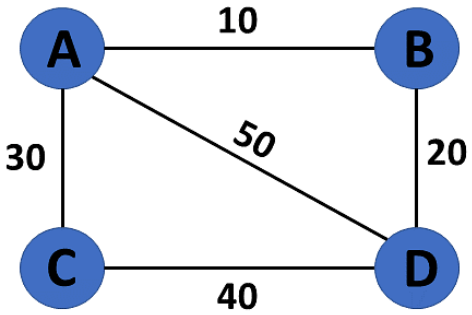
9. Regular Graph

If a graph G= (V, E) is a simple graph with the same degree at each vertex, it is a regular graph. As a result, every whole graph is a regular graph.



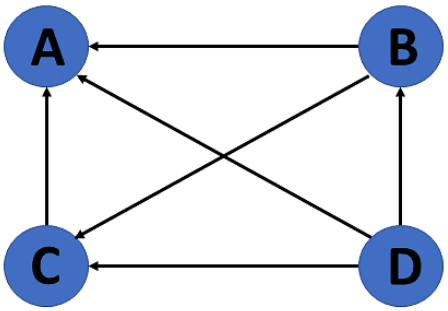
10. Weighted Graph

A graph G= (V, E) is called a labeled or weighted graph because each edge has a value or weight representing the cost of traversing that edge.



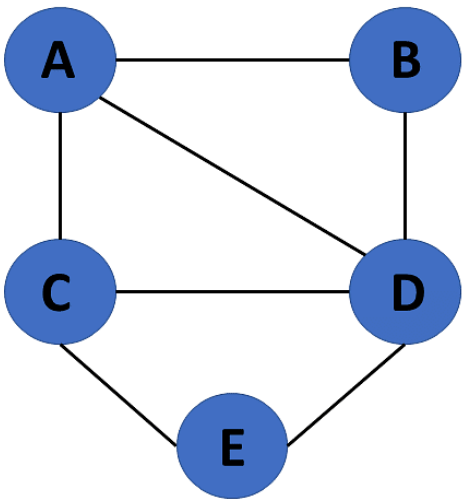
11. Directed Graph

A directed graph also referred to as a digraph, is a set of nodes connected by edges, each with a direction.



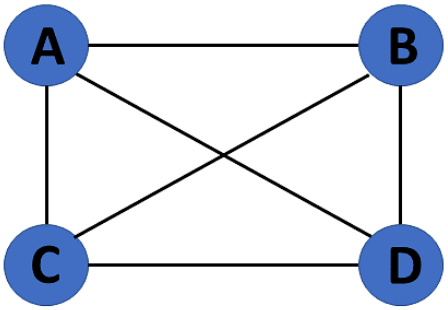
12. Undirected Graph

An undirected graph comprises a set of nodes and links connecting them. The order of the two connected vertices is irrelevant and has no direction. You can form an undirected graph with a finite number of vertices and edges.



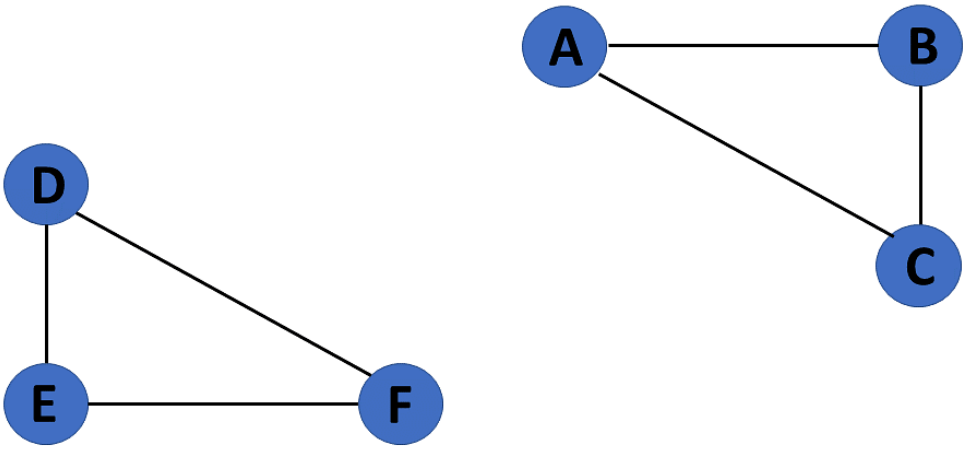
13. Connected Graph

If there is a path between one vertex of a graph data structure and any other vertex, the graph is connected.



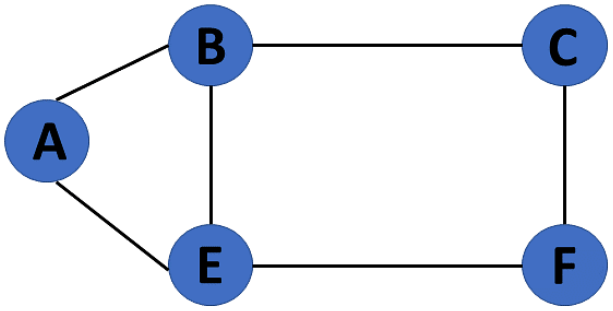
14. Disconnected Graph

When there is no edge linking the vertices, you refer to the null graph as a disconnected graph.



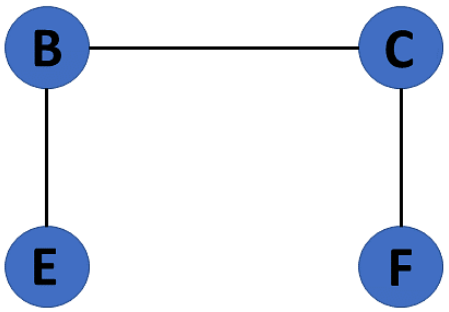
15. Cyclic Graph

If a graph contains at least one graph cycle, it is considered to be cyclic.



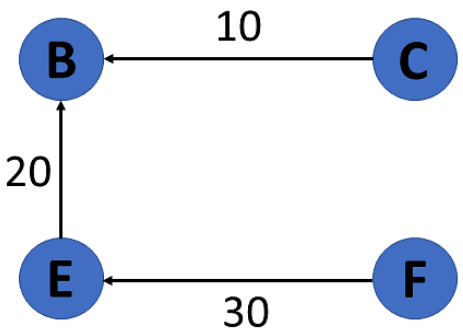
16. Acyclic Graph

When there are no cycles in a graph, it is called an acyclic graph.



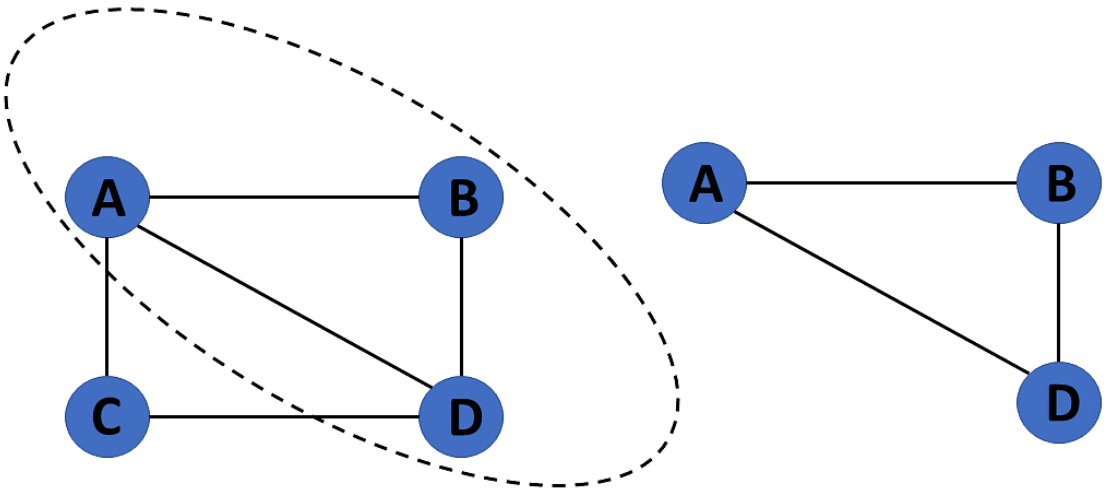
17. Directed Acyclic Graph

It's also known as a directed acyclic graph (DAG), and it's a graph with directed edges but no cycle. It represents the edges using an ordered pair of vertices since it directs the vertices and stores some data.



18. Subgraph

The vertices and edges of a graph that are subsets of another graph are known as a subgraph.



After you learn about the many types of graphs in graphs in data structures, you will move on to graph terminologies.

Terminologies of Graphs in Data Structures

Following are the basic terminologies of graphs in data structures:

- An edge is one of the two primary units used to form graphs. Each edge has two ends, which are vertices to which it is attached.
- If two vertices are endpoints of the same edge, they are adjacent.
- A vertex's outgoing edges are directed edges that point to the origin.
- A vertex's incoming edges are directed edges that point to the vertex's destination.
- The total number of edges occurring to a vertex in a graph is its degree.
- The out-degree of a vertex in a directed graph is the total number of outgoing edges, whereas the in-degree is the total number of incoming edges.
- A vertex with an in-degree of zero is referred to as a source vertex, while one with an out-degree of zero is known as sink vertex.
- An isolated vertex is a zero-degree vertex that is not an edge's endpoint.
- A path is a set of alternating vertices and edges, with each vertex connected by an edge.
- The path that starts and finishes at the same vertex is known as a cycle.
- A path with unique vertices is called a simple path.
- For each pair of vertices x, y, a graph is strongly connected if it contains a directed path from x to y and a directed path from y to x.
- A directed graph is weakly connected if all of its directed edges are replaced with undirected edges, resulting in a connected graph. A weakly linked graph's vertices have at least one out-degree or in-degree.
- A tree is a connected forest. The primary form of the tree is called a rooted tree, which is a free tree.
- A spanning subgraph that is also a tree is known as a spanning tree.
- A connected component is the unconnected graph's most connected subgraph.
- A bridge, which is an edge of removal, would sever the graph.
- Forest is a graph without a cycle.