Graph
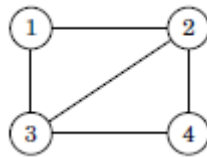
A graph consist of nodes & edges. A path leads from node a to node b through edges of the graph. The length of the path is the number of edges in it path.

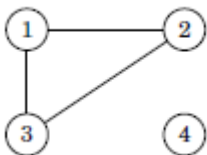A path is cyclic if the start and end node are same. A path is simple if each node appears at most once in the path.

Connectivity
A graph is connected if there is a path between any two nodes. The following graph is connected :
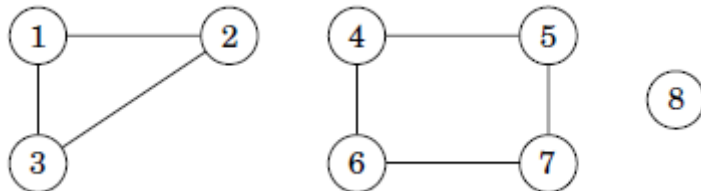
The following graph is not connected because it is not possible to get to node 4 from any other node.
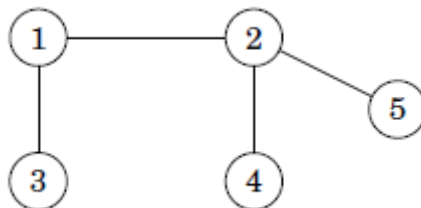
Components
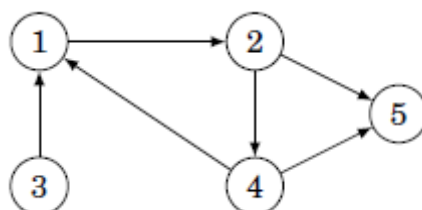The connected parts of a graph are called as components.

A **tree** is a connected acyclic graph that consists of n nodes and n-1 edges. There is a unique path between any two nodes of a tree. For example, the following graph is a tree:
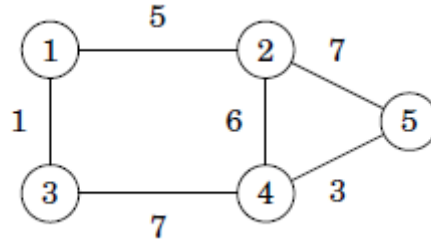
Directed Graph
A graph is directed if the edges can be traversed in one direction only. For example, the following graph is directed:

Weighted Graph

In a weighted graph, each edge is assigned a weight. The weights are often interpreted as edge lengths. For example, the following graph is weighted:

The length of a path in a weighted graph is the sum of the edge weights on the path. For example, in the above graph, the length of the path $1 \rightarrow 2 \rightarrow 5$ is 12, and the length of the path $1 \rightarrow 3 \rightarrow 4 \rightarrow 5$ is 11. The latter path is the **shortest** path from node 1 to node 5.

Neighbors & Degrees

Two nodes are neighbors or adjacent if there is an edge between them. The degree of a node is the number of its neighbors. For example, in the following graph, the neighbors of node 2 are 1, 4 and 5, so its degree is 3.

A graph is regular if the degree of every node is a constant d. A graph is complete if the degree of every node is n-1, the graph contains all possible edges between the nodes.
In a directed graph, the indegree of a node is the number of edges that end at the node, and the outdegree of a node is the number of edges that start at the node.

Colorings

In a coloring of a graph, each node is assigned a color so that no adjacent nodes have the same color.
A graph is bipartite if it is possible to color it using two colors.

A **bipartite graph**, also called a bigraph, is a set of **graph** vertices decomposed into two disjoint sets such that no two vertices of a **graph** within the same set are adjacent.

Simple Graph

A graph is simple if no edge starts and ends at the same node, and there are no multiple edges between two nodes. Often we assume that graphs are simple.