

# What is a Graph?

The lesson explains multiple types and terminologies used in graphs (from basic to complex).

## We'll cover the following

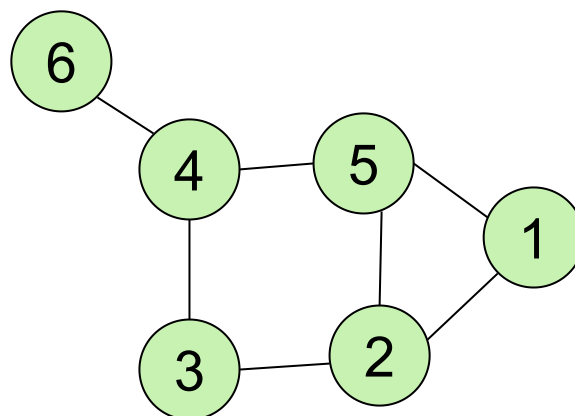


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## Introduction #

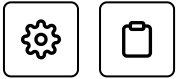
### 🔍 How do you Define a Graph? #

A graph is a set of **vertices** (nodes) that are connected to each other via **edges** in the form of a network.

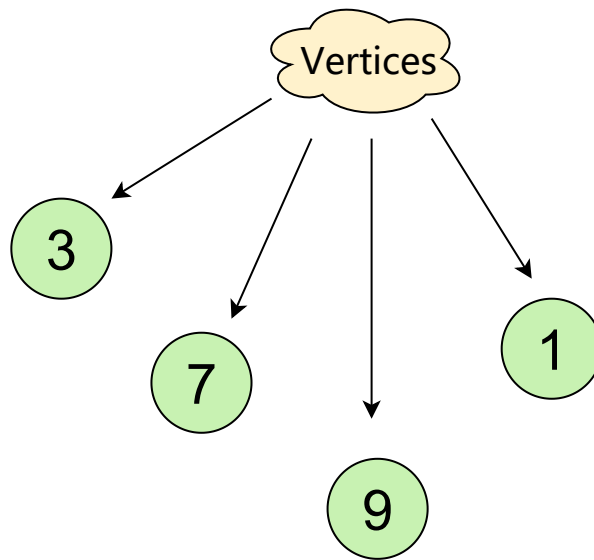


A Graph having 6 nodes and 7 edges

# Vertex: #



The structures for storing data in a graph, represented in the form of *Nodes* (1,3,7...), are also called *Vertices*

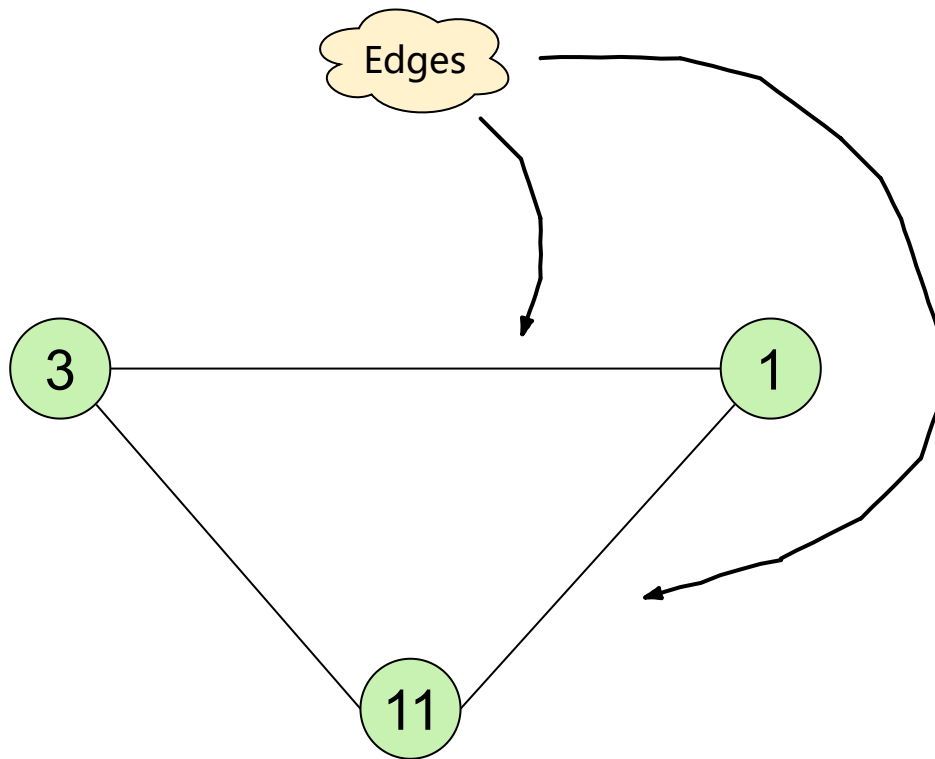


A Graph having 4 Vertices

## Edge: #

A **pair(x,y)** is called an **edge**, which indicates that vertex **x** is connected to vertex **y**. An edge may contain weight/cost, showing how much cost is required to traverse from vertex **x** to **y**.

Edges are usually represented using Straight lines.



A Graph having 3 Edges

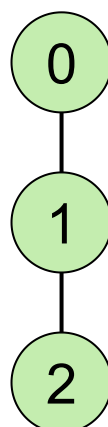
## Types of Graphs #

There are two common types of graphs:

1. Undirected
2. Directed

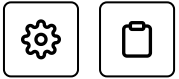
### 1. Undirected Graph #

In an undirected graph, the edges are bi-directional by default; for example, with the **pair (0,1)**, it means there exists an edge between vertex **0** and **1** without any specific direction. You can go from vertex **0** to **1**, or vice versa.

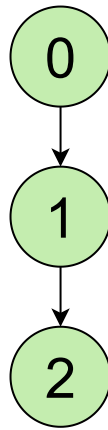


An Undirected Graph having 3 vertices and 2 edges

## 2. Directed Graph #



In a directed graph, the edges are unidirectional; for example, with *the pair*  $(0,1)$ , it means there exists an edge from vertex  $0$  towards vertex  $1$ , and the only way to traverse is to go from  $0$  to  $1$ .



A Directed Graph having 3 vertices and 2 edges

## Graph Terminologies #

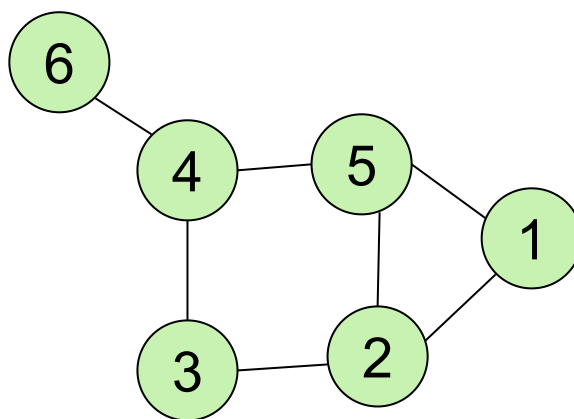
**1. Degree of Vertex:** Total Number of edges connected to a vertex.

Consider the figure given below:

=> Degree of 5 = 3

=> Degree of 1 = 2

=> Degree of 6 = 1

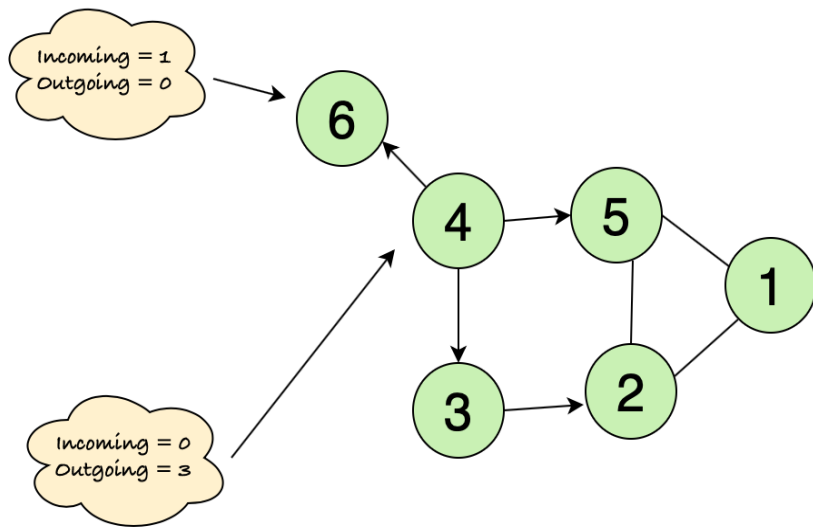


A Graph having 6 nodes and 7 edges

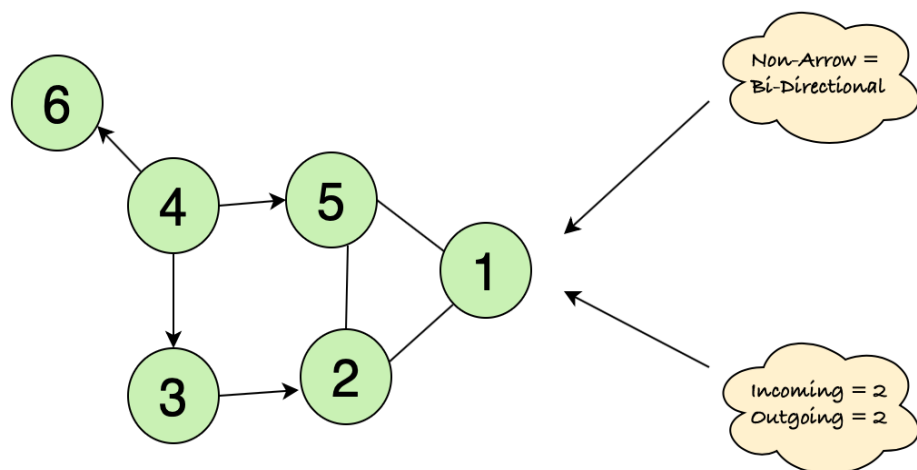
There are two types of degrees:

- **In-Degree of Vertex:** Total Number of incoming edges connected to a vertex.

- **Out-Degree of Vertex:** Total Number of outgoing edges connected to a vertex.

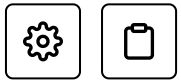
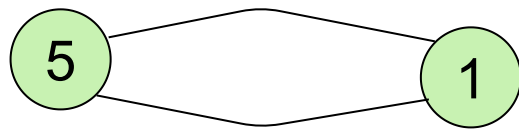
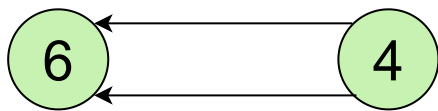


In and Out Degrees of a Directed Graph



In and Out Degrees of an Undirected Graph

**2. Parallel Edges:** Two or more edges that are incident to the same two vertices.

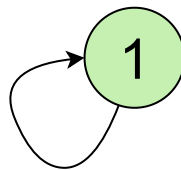


Directed Graph with  
Parallel Edges

Undirected Graph with  
Parallel Edges

Parallel Edged Graphs

### 3. Self Loop: Same endpoints of an edge, e.g., *pair* (x,x).



A graph showing self-loop

In the next lesson, we're going to learn ways to represent a graph data structure, which will help us in implementing it.

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Representation of Graphs

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