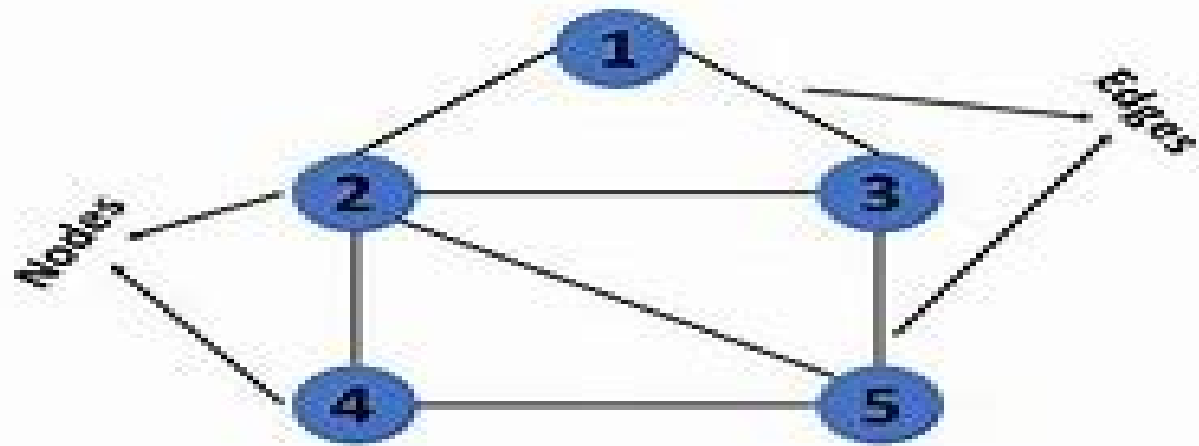


Chapter 6

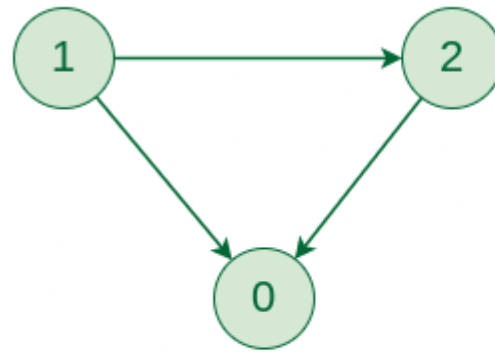
Graph data structure

- **What is Graph Data Structure?**
- A Graph is a non-linear data structure consisting of vertices and edges.
- The vertices are sometimes also referred to as nodes and the edges are lines or arcs that connect any two nodes in the graph.
- More formally a Graph is composed of a set of vertices(V) and a set of edges(E). The graph is denoted by $G(E, V)$.

- Sample graph data structure



- Ex



Directed Graph

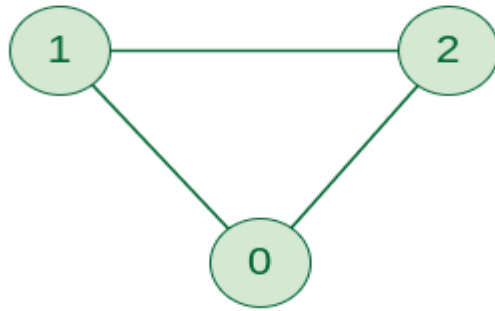


	0	1	2
0			
1	1		1
2	1		

Adjacency Matrix

Graph Representation of Directed graph to Adjacency Matrix

- Ex



Undirected Graph



	0	1	2
0		1	1
1	1		1
2	1	1	

Adjacency Matrix

Graph Representation of Undirected graph to Adjacency Matrix

Real-Time Applications of Graph:

- **Social media analysis:** Social media platforms generate vast amounts of data in real-time, which can be analyzed using graphs to identify trends, sentiment, and key influencers. This can be useful for marketing, customer service, and reputation management.
- **Network monitoring:** Graphs can be used to monitor network traffic in real-time, allowing network administrators to identify potential bottlenecks, security threats, and other issues. This is critical for ensuring the smooth operation of complex networks.

- **Autonomous vehicles:** Graphs can be used to model the real-time environment around autonomous vehicles, allowing them to navigate safely and efficiently. This requires real-time data from sensors and other sources, which can be processed using graph algorithms.
- **Disease surveillance:** Graphs can be used to model the spread of infectious diseases in real-time, allowing health officials to identify outbreaks and implement effective containment strategies. This is particularly important during pandemics or other public health emergencies.
- The best example of graphs in the real world is Facebook. Each person on Facebook is a node and is connected through edges. Thus, A is a friend of B. B is a friend of C, and so on.

- **Advantages of Graph:**

- **Representing complex data:** Graphs are effective tools for representing complex data, especially when the relationships between the data points are not straightforward. They can help to uncover patterns, trends, and insights that may be difficult to see using other methods.
- **Efficient data processing:** Graphs can be processed efficiently using graph algorithms, which are specifically designed to work with graph data structures. This makes it possible to perform complex operations on large datasets quickly and effectively.

- **Pathfinding:** Graphs can be used to find the shortest path between two points, which is a common problem in computer science, logistics, and transportation planning.
- **Visualization:** Graphs are highly visual, making it easy to communicate complex data and relationships in a clear and concise way. This makes them useful for presentations, reports, and data analysis.
- **Machine learning:** Graphs can be used in machine learning to model complex relationships between variables, such as in recommendation systems or fraud detection.
- Graphs are used in computer science to depict the flow of computation.
- Users on Facebook are referred to as vertices, and if they are friends, there is an edge connecting them. The Friend Suggestion system on Facebook is based on graph theory.
- You come across the Resources Allocation Graph in the Operating System, where each process and resource are regarded vertically. Edges are drawn from resources to assigned functions or from the requesting process to the desired resources. A stalemate will develop if this results in the establishment of a cycle.
- Web pages are referred to as vertices on the World Wide Web. Suppose there is a link from page A to page B that can represent an edge. this application is an illustration of a directed graph.

- Reading Assignment