

Graph Theory

- The graph theory can be described as a study of points and lines.
- Graph theory is used to deal with study of a graph.
- Graph theory is introduced by Euler.

Graph

A Graph is a set of vertices (or nodes) and edges (E).

↓
Set of Edges



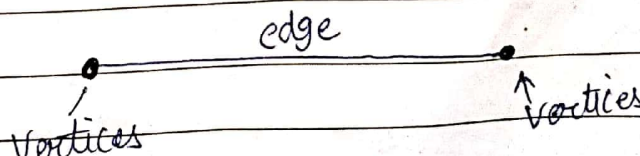
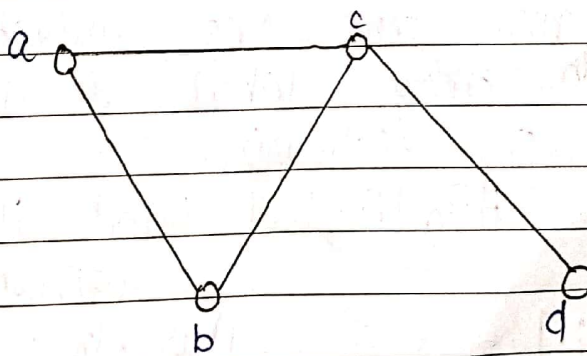
V (Set of vertices)

- It is denoted as $G = (V, E)$

Example - let us consider a graph as $G = (V, E)$

$$V = \{a, b, c, d\}$$

$$E = \{ea, by, eac, ebc, ec, d\}$$



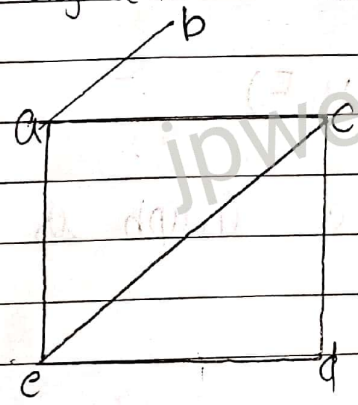
Representation of Graphs

There are mainly two ways to represent a graph

- Adjacency List
- Adjacency Matrix

(i) ADJACENCY LISTS:-

It is a way to represent a graph without multiple edges. It specifies all the vertices that are adjacent to each vertex of a graph



→
Adjacency list

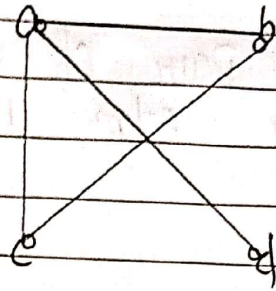
Vertex	Adjacent Vertices
a	b, c, e
b	a
c	a, d, e
d	c, e
e	a, c, d

(ii) ADJACENCY MATRICES:-

A (A_G) is a $n \times n$ zero-one matrix with 1 as its $(i, j)^{th}$ entry when i and j are adjacent and 0 otherwise.

$$A[v_x][v_y] = 1 \text{ and } A[v_y][v_x] = 1, \text{ otherwise zero}$$

$$A = [a_{ij}] = \begin{cases} 1 & \text{if } (i, j) \text{ is edge of } G \\ 0 & \text{otherwise} \end{cases}$$



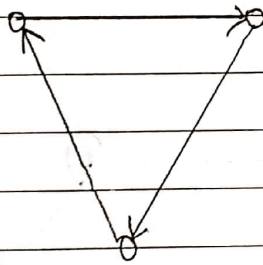
	a	b	c	d
a	0	1	1	1
b	1	0	1	0
c	1	1	0	0
d	1	0	0	0

Types of Graph

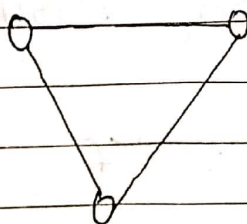
There are different types of graphs. But, mainly there are basically two types of graphs.

- Directed Graph
- Undirected Graph

Directed Graph: In the directed graph, the edges have a direction which is associated with the vertices.

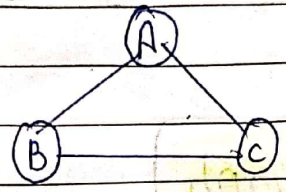


Undirected Graph: A Graph is called undirected if the edge set is made of unordered vertex pair.



◦ Complete Graph

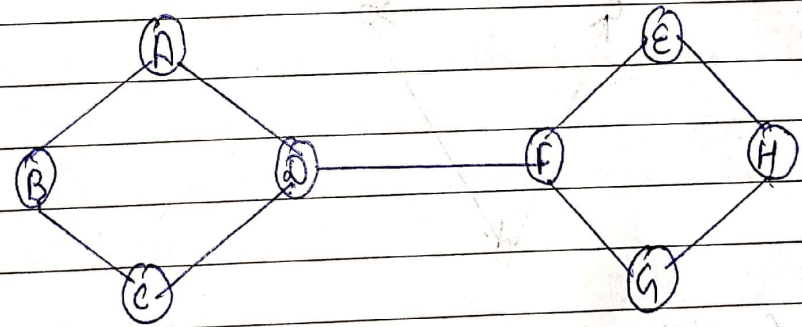
A graph in which every pair of vertices is joined by exactly one edge is called Complete graph.



◦ Connected graph

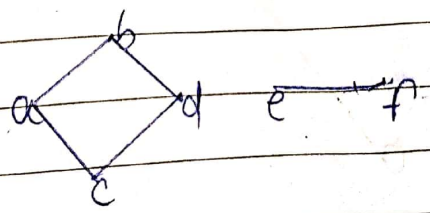
A Connected graph is a graph in which we can visit from any one vertex to any other vertex.

◦ At least one edge or path exists between every pair of vertices.



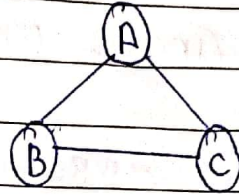
◦ Disconnected Graph

A disconnected graph is a graph in which any path does not exist between every pair of vertices.



Regular Graph

A Regular graph is a graph in which degree of all vertices is same.

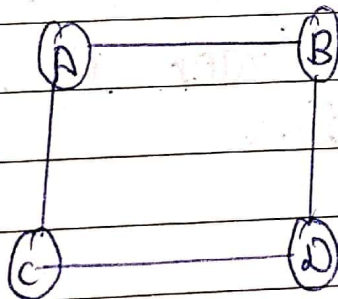


Cyclic Graph

A graph with 'n' vertices ($n \geq 3$) and 'n' edges forming a cycle of 'n' with all its edges is known as Cycle graph.

→ degree of each vertex is 2.

A graph containing atleast one cycle in it is known as Cyclic graph



Notes by :- jpwbe developers