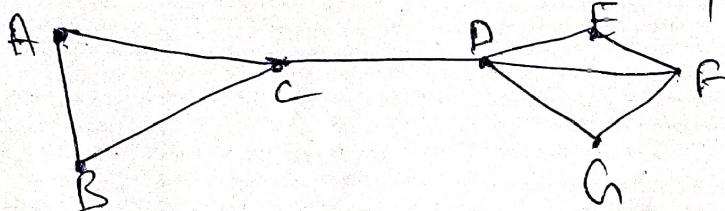


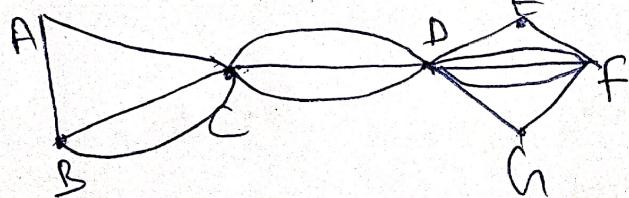
Graph: - A graph $G = (V, E)$, consists of V , a non-empty set of vertices & E , a set of edges.

Types of Graph:

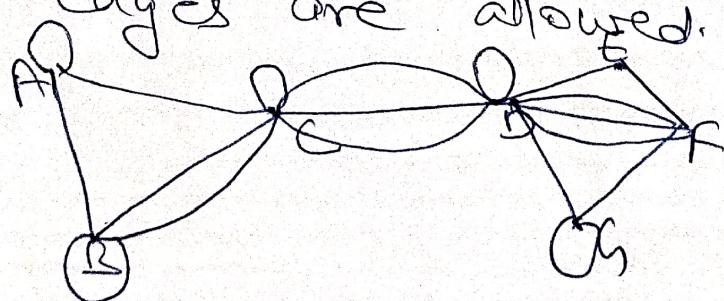
- ① Simple Graph: - A graph in which each edge connects two different vertices & where no two edges connect the same pair of vertices is called a simple graph.



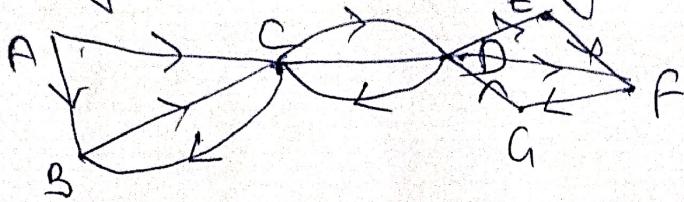
- ② Multigraph: - A graph in which there are multiple edges connecting the same pair of vertices is called a multigraph.



- ③ Pseudograph: - A graph in which loops & multiple edges are allowed.



Directed Graph :- A directed graph (V, E) , consists of a non empty set of vertices V & a set of directed edges E .

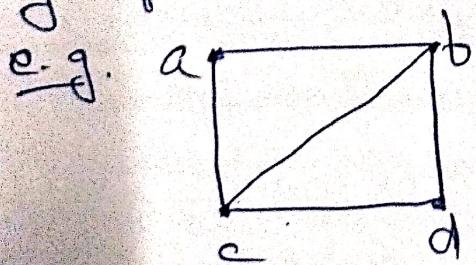


Defⁿ :- Two vertices u & v in an undirected graph G are called adjacent if u & v are end points of an edge of G .

If e is associated with $\{u, v\}$, the edge is called incident with vertices u & v .

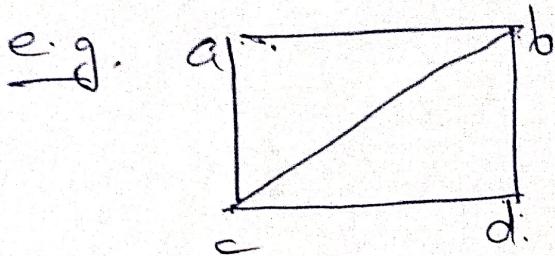
Defⁿ :- The degree of a vertex in an undirected graph is the no. of edges incident with it except that a loop at a vertex contributes twice to the degree of that vertex. The degree of the vertex is denoted by $\deg()$.

Path :- A path is a sequence of edges that begins at a vertex of a graph & travels from vertex to vertex along edges of the graph.



a, b, c, d → is a path.
c, d, b, c, a → is a path.

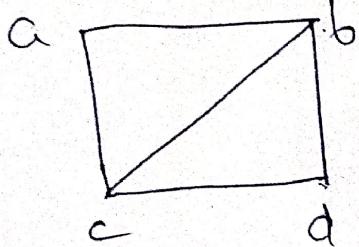
Circuit - A circuit is a path that begins & ends at the same vertex.



a, b, c, a \rightarrow circuit

a, b, c, a, b, d \rightarrow circuit

Simple Path & Circuit - A path or circuit is simple if it does not contain the ^{some} edge more than once.

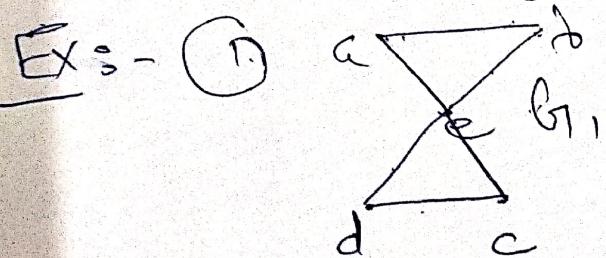


a, b, c, a \rightarrow simple circuit
a, b, c, a, b, d \rightarrow not a simple circuit

Euler Circuit & Path

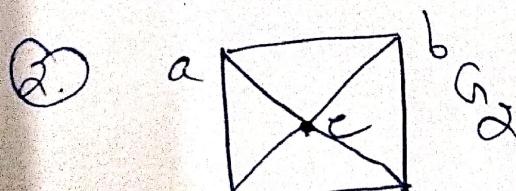
An Euler Circuit in a graph G is a simple circuit containing every edge of G .

An Euler path in a graph G is a simple path containing every edge of G .

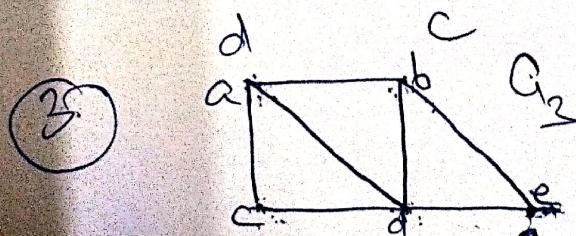


$\Rightarrow G_1$ has Euler circuit,
a, c, c, d, e, b, c.

(or a, b, e, c, d, e, a)



G_2 has no Euler circuit,
& no Euler path,



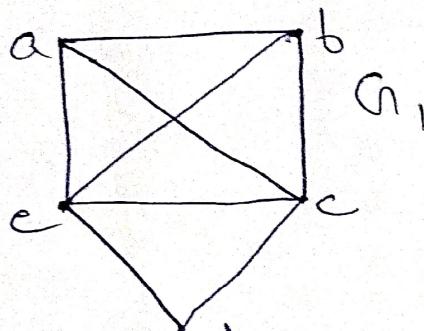
G_3 has an Euler path
a, c, d, a, b, d, e, b
(or a, c, d, e, b, d, a, b)

Hamilton Paths & Circuits:-

Hamilton Path :- is a simple path in a graph G that passes through every vertex exactly once is called a Hamilton path.

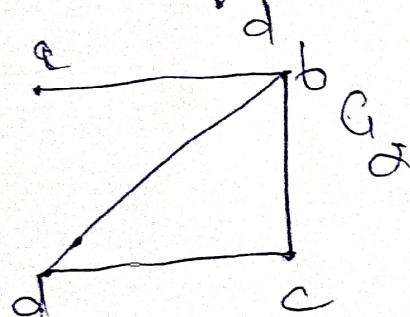
Hamilton Circuit :- is a simple circuit in a graph G that passes through every vertex exactly once is called a Hamilton circuit.

Ex:- ①



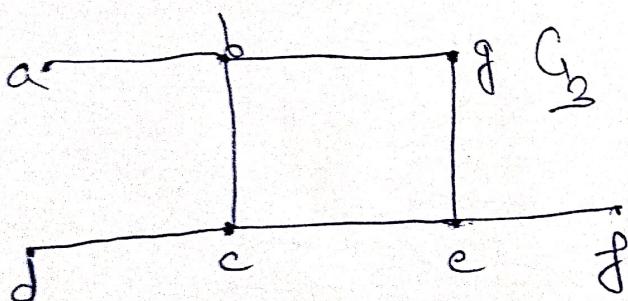
G_1 has a Hamilton circuit,
 a, b, c, d, e, a

②



G_2 has a Hamilton path, a, b, c, d but no Hamilton circuit

③



G_3 has neither a Hamilton circuit nor a Hamilton path.