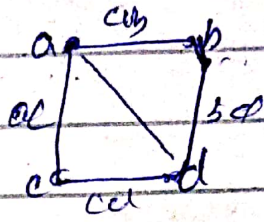
Graphs

are non-linear data structure consists of a pair of Vertices & Edges (V, E)

$G = (V, E)$
$V = \{a, b, c, d\}$
$E = \{ab, bc, cd, ad\}$



Size = 4 no of edges

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A graph with an infinite vertex set or an infinite edges is called <u>infinite</u> graph.

A graph with a finite vertex set or a finite edges is called <u>finite</u> graph.

A graph in which each edge connects two different vertices and where no two edges connects the same pair of vertices is a <u>simple graph</u>

Graphs that may have multiple edges connecting the same vertices are called multigraphs

An edge that connect a vertex to itself is called loop (edge).

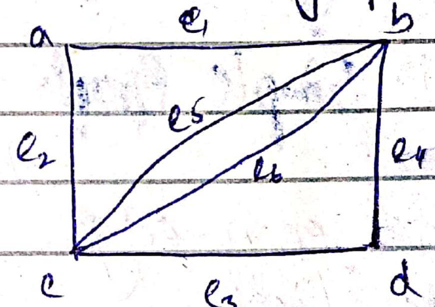
Graphs that may include loops and multiple edges connecting the same pair of vertices are called phesudographs.

Graphs containing multiple edges connected to same pair of vertices and having no direction are called undirected.

A graph consists of a nonempty set of vertices V and a set of directed edges is called directed graph.

A graphs that donot have multiple directed edges connected to same pair of vertice is called simple directed graph.

A graph with multiple undirected and directed edges is called mixed graph



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

$E\{e_1, e_2, e_3, e_4, e_5, e_6\}$

Parallel edges

Edges having same starting and ending vertices

e_5 & e_6 are parallel edges

Adjacent Vertex

The vertices connected to a vertex are its adjacent vertices.

a → b, c

b → a, c, d

c → a, b, d

d → c, b

Degree of Vertex

The number of vertices connected to a vertex is its degree

deg (a) = 2

deg (b) = 3

" (c) = 3

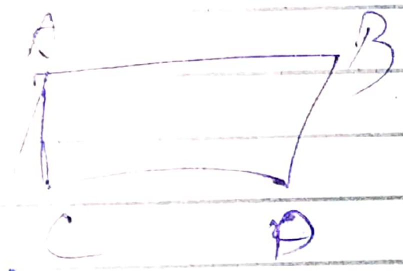
" (d) = 2

Types of Graphs

(i) Simple Graph

The graph that donot include loop and each edge connects two diff pair of vertices.

e.g



Cyclic Graph

A walk is closed if endpoints are same. Such graph is called cyclic Graph

e.g

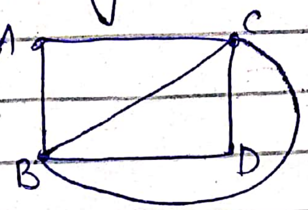
Directed Graph:
Completen Directed Graph:
Sub-Graph:

Null Graph
Disconnected Graph

Planner Graph

In planner graph there is no cross edges

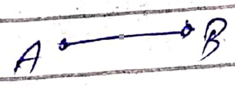
e.g



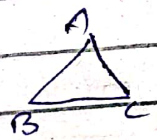
Regular Graph

The graph that have equal edgree of vertices

e.g



deg(A) = 1
deg (B) = 1

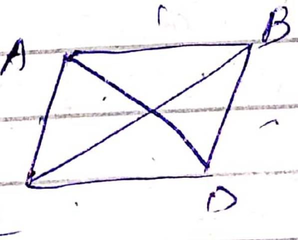


deg (A) = 2
" (B) = 2
" (C) = 2

Complete Graphs

A graph in which each pair of vertices is connected by an edge.

e.g



Edges of complete graph:

Total no of edges in a complete graph is given by

$$edges = \frac{n(n-1)}{2}$$

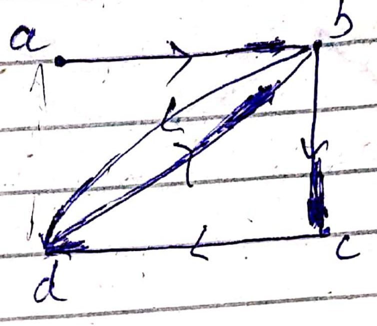
$\because n =$ no of vertices

Eular & Hamilton Path

Eular Path:- A Eular path visits every edge once.

=> An Eular path is possible, if exactly two vertices have odd degree ~~and graph is directed graph~~

Example

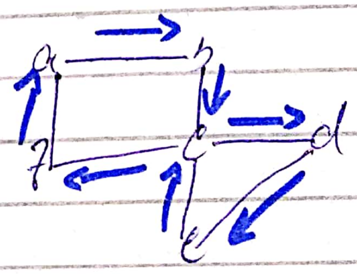


Euler path:

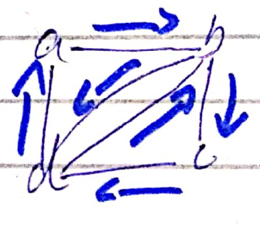
a → b → c → d → b → d

Eular circuit / cycle:- An euler circuit or cycle visit every edge once and "begins" and "ends" at the same vertex.

Example 1



Example 2

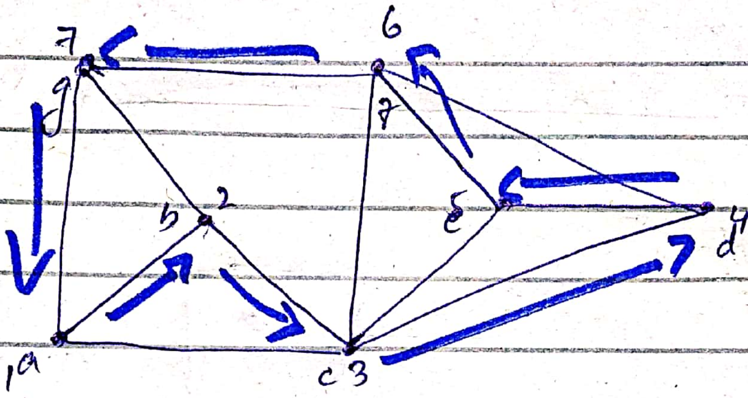


=> An euler circuit is possible if it have even edges.

Hamilton Path

A hamilton path visits every vertex once.

Example:-



Hamilton Path:

ab -> bc -> cd -> de -> ef -> fg