Graph

A graph is a non linear data structure, which consists of points known as nodes (vertices) and set of links known as edges (Arcs) which connects the vertices.

or

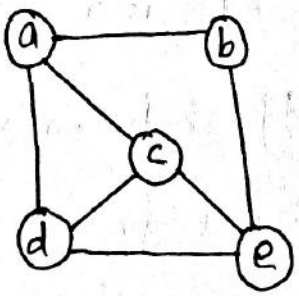
A Graph $G_1 = (V, E)$ is composed of

V : Set of vertices

E : set of edges connecting the vertices in V.

• An edge $e = (u, v)$ is a pair of vertices.

Example :



$G_1 = (V, E)$

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

$E = \{(a,b), (a,c), (a,d), (b,e), (c,d), (c,e), (d,e)\}$

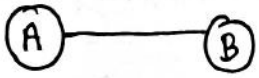
Graph Terminology :

Vertex : An individual data element of a graph is called as Vertex. vertex is also known as node. In above example graph, a, b, c, d and e are known as vertice

Edge :— An edge is a connecting link between two vertices. Edge is also known as Arc. in above graph, the link between vertices a and b is represented as (a,b).

Edges are three types

↳ Undirected Edge – An undirected edge is a bidirectional edge. if there is an undirected edge between vertices A and B then edge (A,B) is equal to edge (B,A).

ex: 

: (A,B) = (B,A)

↳ Directed Edge – A directed edge is a unidirectional edge. if there is a directed edge between vertices A and B then edge (A,B) is not equal to edge (B,A)

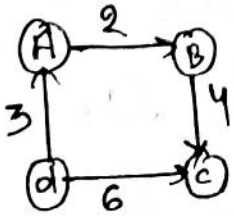
ex:

: edge (A,B)

: edge (B,A)

So, edge(A,B) ≠ edge (B,A)

↳ weighted Edge – A weighted edge is an edge with cost on it.

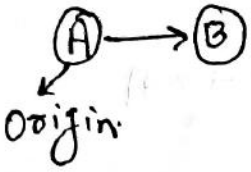
ex: 

in this example edge (A,B) is associated with cost 2.

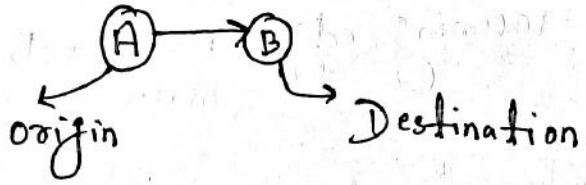
↳ End vertices or End Points : The two vertices joined by edge are called end vertices (or end points) of that edge

↳ Origin : if a edge is directed, its first endpoint is said to be the origin of it

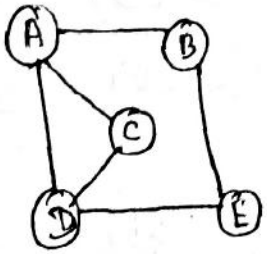
ex:



↳ Destination : if a edge is directed, its first endpoint is said to be the origin of it and the other end point is said to be the destination of that edge.



↳ Adjacent : if there is an edge between vertices A and B then both A and B are said to be adjacent. In other words, vertices A and B are said to be adjacent if there is an edge between them.

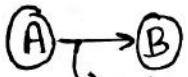


Adjacent vertices of A : B, C and D
" " B : A and E
" " C : A and D
" " D : A, C and E
" " E : B and D.

↳ Incident: Edge is said to be incident on a vertex if the vertex is one of the endpoints of that edge.

↳ Outgoing Edge: A directed edge is said to be outgoing edge on its origin vertex.

ex:



↳ outgoing edge of vertex A

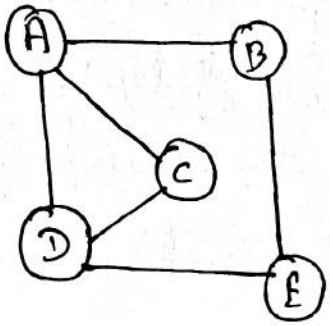
↳ Incoming Edge: A directed edge is said to be incoming edge on its destination vertex

ex:

incoming edge on vertex B.

↳ Degree: Total number of edges connected to a vertex is said to be degree of that vertex.

ex:



$d(A) = 3$ $d(C) = 2$

$d(B) = 2$ $d(D) = 3$

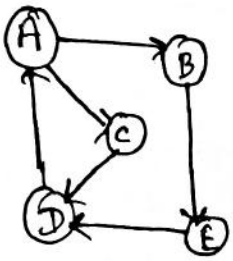
$d(E) = 2$

Note: → Sum of the degrees of the vertices is equal to twice the number of edges.

↳ Indgree: Total number of incoming edges connected to a vertex is said to be indegree of that vertex.

↳ Outdegree: Total number of outgoing edges connected to a vertex is said to be outdegree of that vertex.

Ex:



$deg_{in}(A) = 1 \quad deg_{out}(A) = 2$

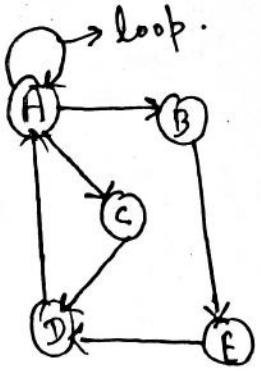
$deg_{in}(B) = 1 \quad deg_{out}(B) = 1$

$Deg_{in}(C) = 1 \;, Deg_{out}(C) = 1$

$Deg_{in}(D) = 2, \; Deg_{out}(D) = 1, \; Deg_{in}(E) = 1, Deg_{out}(E) = 1$

↳ Self-loop: Edge (undirected or directed) is a self-loop if its two endpoints concide with each other.

Ex:



$deg_{in}(A) = 2$

$deg_{out}(A) = 3$

↳,