

Graphs

→ A Data Structure :- which is used to represent pairwise relation b/w objects

App! :- MAPS.

① Directed graphs → represent as a pair (V, E)
Vertices V and Edges E .

→ Edges are represented as ordered pairs

② Undirected graphs :-

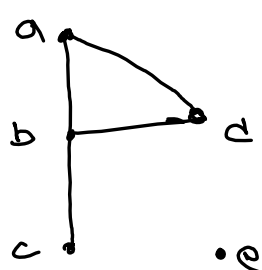
→ Edges are represented as unordered pairs

(u, v) → edge. directed starts from u .

Degree of vertex :-

$$\deg(v) \leq n-1$$

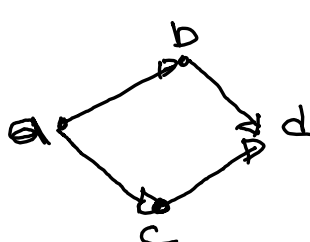
* Undirected



→ $\deg(a) = 2$
 $\deg(b) = 3$
 $\deg(c) = 1$ → pendant vertex
 $\deg(e) = 0$ → isolated.

* Directed

indegree $\deg^-(v)$ outdegree $\deg^+(v)$



	indegree $\deg^-(v)$	outdegree $\deg^+(v)$
a	0	2
b	1	1
c	1	1
d	2	0

* Connected graph :- Path b/w Every Pair of vertices.

* Complete graph

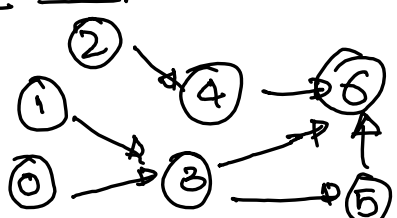


* Multi-graph :- multiple edges b/w two vertices.

* Representation :-

→ most common → adjacency list → sparse graphs
→ adjacency matrix → dense graphs

Adjacency matrices :-



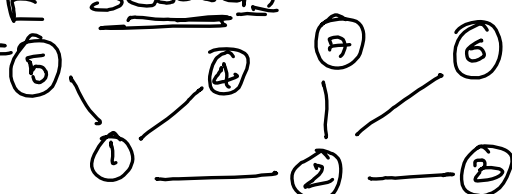
	0	1	2	3	4	5	6
0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	0
2	0						
3	0						
4	0						
5	0						
6	0						

A^2 represents → no. of Paths of length 2
from vertex i to j

$A^2 = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix}$ 0 to 6 is ①-③-⑥

Graph Traversal Algorithms → visiting all vertices and edges.

Breadth first Search



BFS :- 1, 2, 4, 5, 3, 6, 7

Depth first Search DFS :- 1, 2, 3, 6, 7, 4, 5