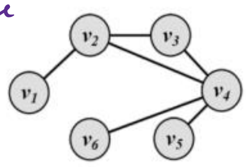
Graph representation

① Adjacency matrix — rows, columns = nodes.

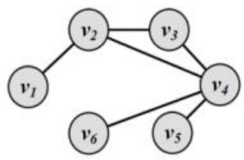
Social media networks have sparse adj. matrices.

$a_{ij} = 1$ if connection b/w i,j
$= 0$ otherwise.



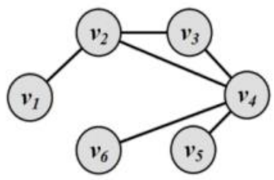
	v_1	v_2	v_3	v_4	v_5	v_6
v_1	0	1	0	0	0	0
v_2	1	0	1	1	0	0
v_3	0	1	0	1	0	0
v_4	0	1	1	0	1	1
v_5	0	0	0	1	0	0
v_6	0	0	0	1	0	0

② Adjacency list — for every node, list all connected nodes] sort based off pref or whatever.



Node	Connected To
v_1	v_2
v_2	v_1, v_3, v_4
v_3	v_2, v_4
v_4	v_2, v_3, v_5, v_6
v_5	v_4
v_6	v_4

③ Edge list — just the set of all connected nodes.



(v_1,v_2)
(v_2,v_3)
(v_2,v_4)
(v_3,v_4)
(v_4,v_5)
(v_4,v_6)

Terminology

① Two nodes = adjacent if connected via edge (can be transversed)
= incident if connected via endpoint.
→ node + edge incident if node connects to edge.

② WALK — sequence of incident edges visited one after the other
— repetition ✓

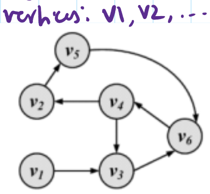
→ Random walk: next step @ each node = random among neighbors.

represent as — set of edges: e1, e2, e... en
— set of vertices: V1, V2, ... Vn

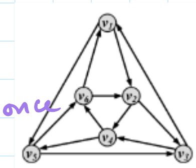
closed: $x_i = x_f$
open: $x_i \neq x_f$

length of walk = no. of visited edges.

Length of walk= 8



③ TRAIL — walk w/ NO REPETITION OF EDGE
— unique set of edges/vertices
→ closed trail = tour/circuit → Eulerian Tour
- all edges traversed once
- Konigsberg bridge.



④ PATH — walk w/ NO REPETITIᴺ OF (EDGE + VERTEX)
— length = no. of edges visited.

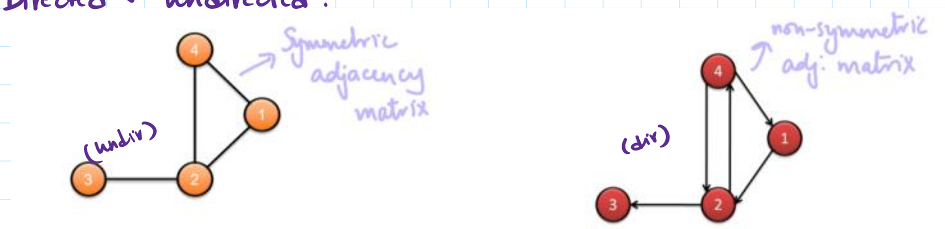
④ PATH — walk w/ NO REPETITⁿ OF (EDGE + VERTEX)
└ length = no. of edges visited.

Types of graphs

① Null graph — empty set : $G(V, E)$, $V = E = \phi$

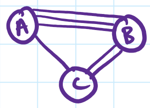
② Empty graph — edgeless graph. Only $E = \phi$

③ Directed + undirected :



④ Simple graph — one edge b/w any node pair

⑤ Multigraph — ≥1 edge b/w node pairs.

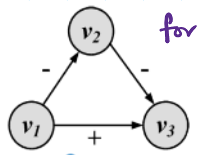


— adj. matrix can have no. > 1.

⑥ Weighted graph — edge associated w/ weight, weight has some meaning.

⑦ Web graph — represents internet sites — directed multigraph.

⑧ Signed graph — weighted graph w/ binary weights →



for friends, foes.
social status too.

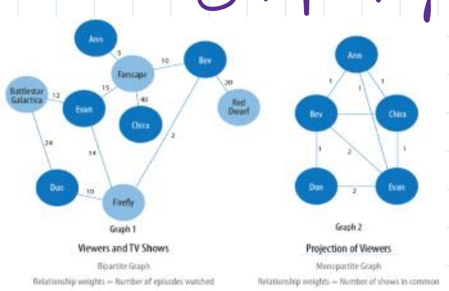
⑨ Connected graph — path b/w all nodes

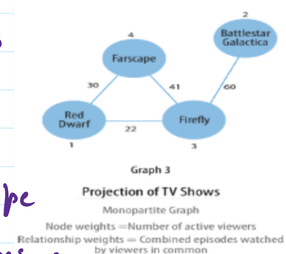
⑩ Disconnected graphs — if islands exist.
↓
if nodes in island are connected,
→ components / clusters.

⑪ K-partite graphs — no. of node types = k.
└ graph where vertices can be partitioned into k diff independent sets.

Bipartite : k = 2
nodes belong to 2 sets

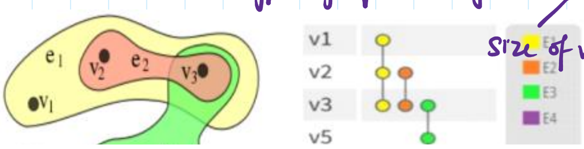
Monopartite : k = 1
only 1 node + relation type
project w/ inferred connections.





⑫ Hypergraph — generalization of undirected graphs — edges are subsets of 2≥ vertices.

size of vertex set = order
size of edge set = size



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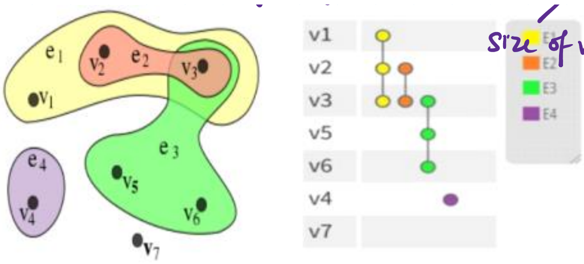
size of vertex set = order

size of edge set = size



Undirected hypergraph G = (V,E) i.e. with

X= { v1,v2,v3,v4,v5,v6,v7 } with E = { e1,e2,e3,e4} = { { v1,v2,v3}, {v2,v3}, { v3,v5,v6}, {v4}}. This hypergraph has order 7 and size 4 (no of hyperedges)