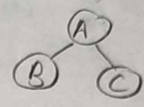
Graphs

→ set of (V, E) pairs
V → vertices set
E → set of edges

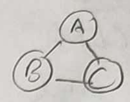


Graph/Tree

A, B, C → vertices
{A,B
A,C} → edges

→ vertices → Represented as circles also known as nodes.

→ Edges → Represented as lines connecting 2 vertices/nodes

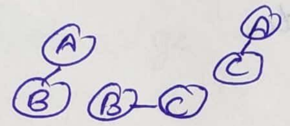


Graph

AB
BC → edges
AC

Terminology →

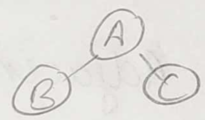
① Adjacent nodes →



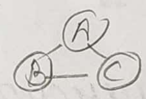
A & B
B & C

C & A which connect same edge

② Degree of Node → No. of edges connected to that node

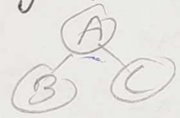


A → 2
C → 1



A
B → 2
C

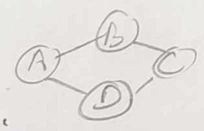
③ Size of graph → Total no. of edges in graph



size = 2

size → 3

④ path → sequence of vertices from source node to destination node. (vertices & edges not repeat)



A → C → A → B → C
or
A → D → C

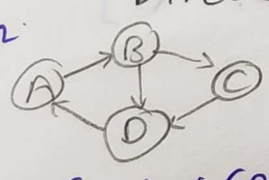
<A, B, C>

⑤ Trail → a walk in which no edge is repeated

Types of Graphs →

① Directed or digraph

undirectn

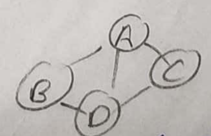


(B, C)

(A, B) ≠ (B, A)

in 1 direction

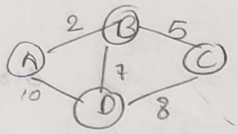
undirected



Bidirectional
{B, C}

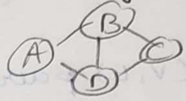
(A, B) = (B, A)
(B, C) = (C, B)
can go in any direction

② Weighted

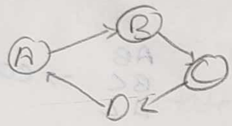


cost/weight is specified for every edge

Unweighted



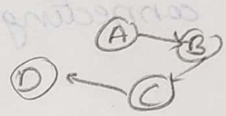
③ CYCLIC



starting node = end node

$A \to B \to C \to D \to A$

ACYCLIC



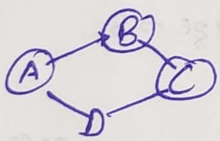
 self loop

A can have edge with itself

↓ can be used to refresh a page

Representation →

① By using multidim. array → Adjacency Matrix



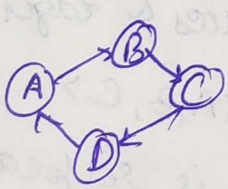
$$\begin{array}{c|cccc} & A & B & C & D \\ \hline A & 0 & 1 & 0 & 1 \\ B & 1 & 0 & 1 & 0 \\ C & 0 & 1 & 0 & 1 \\ D & 1 & 0 & 1 & 0 \end{array}$$

0 → if edge not

1 → if edge yes

A to A → 0

A to B → 1

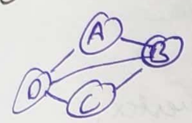


$$\begin{array}{c|cccc} & A & B & C & D \\ \hline A & 0 & 1 & 0 & 0 \\ B & 0 & 0 & 1 & 0 \\ C & 0 & 0 & 0 & 1 \\ D & 1 & 0 & 0 & 0 \end{array}$$

★ V are represented as → $\{ v_1, v_2, v_3, v_4 \}$

E as → $\{ \{v_1, v_2\}, \{v_3, v_4\} \}$

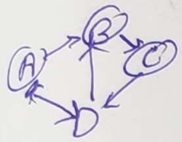
② using list →



→ A is having edge to B, D

A : [B|] → [D|X]
B : [A|] → [C|X]
C : [B|] → [D|X]
D : [A|] → [B|] → [C|X]

also like
A : B, D
B : A, C
C : D
D : A, B, C



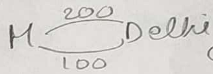
A : [B|] → [D|X]
B : [C|X]
C : [D|X]
D : [B|X]

A : B, D
also rep. like this

Properties →

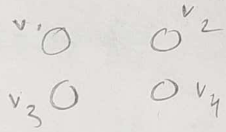
① Multiedge / Parallel edge →

like in airlines M —200/100— Delhi could have diff cost



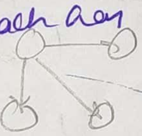
② No. of edges →

min → 0



$V = \{v_1, v_2, v_3, v_4\}$
$|V| = 4$
$|E| = \phi$

max in directed → Node × edge each node
$= 4 \times 3$
$= 12$



if $|V| = n$
then $0 \leq |E| \leq n(n-1)$ (directed)
$0 \leq |E| \leq \frac{n(n-1)}{2}$ (undirected)

Graph is called dense → too many edges
called sparse → less edges