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Propositional Logic: A proposition is a 'declarative statement.
- It must be either true or false.
- It cannot be both (T or F).

Eg: i) John loves Maths
ii) 2+3 = 5
iii) Sun rises from East.

Non-propositional examples: i) Does John loves Math?
ii) $2+x=3$

Conjunctions ($\wedge$): Conjunction ($\wedge$) which corresponds to AND operation.

Eg: P and q is True iff $p \overset{AND}{\wedge} q$ both are true.
($p \wedge q$)

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

SharkCoders

either. Disjunction ($\vee$): Disjunction ($\vee$) which corresponds to OR operation

Eg: $p \vee q$ is true iff p OR q is true.
John is smart or honest.

p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

if-then Implication ($\longrightarrow$): ~~Under the~~ Another binary operator is implication.

Eg: If the car cost less than 1 lakh, then John will buy it.

p	q	$p \to q$
T	T	T
T	F	F
F	T	T
F	F	T

Note: When p is false $p \to q$ always true. ~~by~~

$p \to q$ is false if p is true & q is false

Bi-directional Implication ($\leftrightarrow$): This bi-directional implication corresponds to $p \leftrightarrow q$.

Eg: Student gets O grade iff, his weightage or marks more than 90 marks.

p	q	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

Translating logical formulas to English sentence.

p: John is smart

q: John is honest.

1. $(\neg p) \wedge q$: John is not smart but he is honest
2. $p \vee (\neg p \wedge q)$: Either John is smart or he is not smart but he is honest.
3. $p \to (\neg q)$: If John is smart then he is not honest.

De-Morgan's Law

1. $-(p \wedge q) = -p \vee -q$

2. $-(p \vee q) = -p \wedge -q$

1. $-(p \wedge q) = -p \vee -q$

p	q	$p \wedge q$	$\boxed{-(p \wedge q)}$	$-p$	$-q$	$\boxed{-p \vee -q}$
T	T	T	F	F	F	F
F	F	F	T	T	T	T
T	F	F	T	F	T	T
F	T	F	T	T	F	F

Hence proved.

2. $-(p \vee q) = -p \wedge -q$

p	q	$p \vee q$	$\boxed{-(p \vee q)}$	$-p$	$-q$	$\boxed{-p \wedge -q}$
T	T	T	F	F	F	F
F	F	F	T	T	T	T
F	T	T	F	T	F	F
T	F	T	F	F	T	F

Hence proved.

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CNF – Product of elementary sums

DNF – Sum of elementary sums.

CNF - $(P \vee Q) \wedge (Q \vee R) \wedge (P \vee R \vee Q)$

DNF – $(P \wedge Q) \vee (Q \wedge R) \vee (P \wedge R \wedge Q)$

$\neg$ or $\sim$ or – negation.

Conversions of CNF

1. Eliminate ($\leftrightarrow$) & ($\rightarrow$)
Convert any bidirectional ~~and~~ implication into their logical equivalent

e.g. $p \rightarrow q$ becomes $(\sim p \vee q)$

2. Apply De-morgan's law:

e.g. $\sim(A \vee B)$ becomes $\sim A \wedge \sim B$

3. Distributive law

e.g. $A \vee (B \wedge C) = (A \vee B) \wedge (A \vee C)$

Conversion of DNF

1. Distributive law.
e.g. $A \wedge (B \vee C) \equiv (A \wedge B) \vee (A \wedge C)$

2. De-Morgan's law
e.g. $\sim(A \vee B) \equiv \sim A \wedge \sim B$

3. Eliminate ($\leftrightarrow$) & ($\rightarrow$)
e.g. $A \rightarrow B$ becomes $\sim A \wedge B$.

Principle maxterms CNF (PCNF)

Any equivalent formula consisting of conjunction of max terms only. ~~Conjunction of maxterms only~~ called as PCNF.
It is also known as product of sums canonical form.

product

e.g. $(P \vee \sim Q \vee \sim R) \wedge (P \vee \sim Q \vee R) \wedge (\sim P \vee \sim Q \vee \sim R)$.

sums

The maxterm consists of disjunctions in which each variable or its negation, but not both, appears only once.

The dual of minterms is called a maxterm. Each of the maxterm as the truth value falls False (F) for exactly one combination of the truth values of the variable. The maxterms are written by including the variables, if its truth value is false(F) and its negation, if its truth value is true (T).

Principle DNF (PDNF) minterms sum of product in canonical form

e.g. $(P \wedge \sim Q \wedge R) \vee (\sim P \wedge Q \wedge \sim R) \vee (\sim P \wedge \sim Q \wedge \sim R)$.

product sums.

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Obtain DNF for $P \wedge (P \to R)$

Sol^n: $P \wedge (P \to R)$

Since, $P \to R \equiv \sim P \vee R$

$= P \wedge (\sim P \vee R)$

$= (P \wedge \sim P) \vee (P \wedge R)$ ---- Distributive law

$= F \vee (P \wedge R)$ ..... $P \wedge \sim P =$ False is F

$= P \wedge R$

So, $P \wedge (P \to R) \equiv P \wedge R$

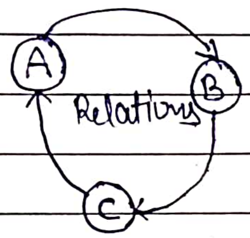
PDNF = minterms
PCNF = maxterms

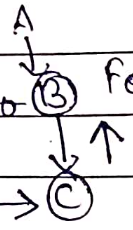
* Minterms of 2 variables

$x \& y = 2^2 = 4$

x	y	$\sim x$	$\sim y$	$x \wedge y$	$x \wedge \sim y$	$\sim x \wedge y$	$\sim x \wedge \sim y$
T	T	F	F	T	F	F	F
T	F	F	T	F	T	F	F
F	T	T	F	F	F	T	F
F	F	T	T	F	F	F	T

Chapter - 2

~~Ans.~~ 

~~1. Relatio~~ 

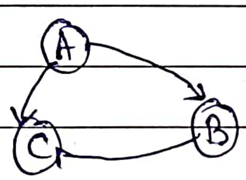
Few feature from A.

feature → C

Few from A & B.

1. Reflexive
2. Irreflexive
3. Symmetric
4. Asymmetric
5. Transitive.

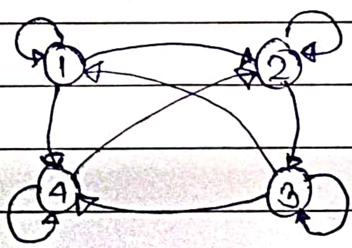
e.g. if $A \rightarrow B$
& $B \rightarrow C$
& $C \leftarrow A$ Find & Draw the relation.



Degree of vertex A = 0
B = 1
C = 2

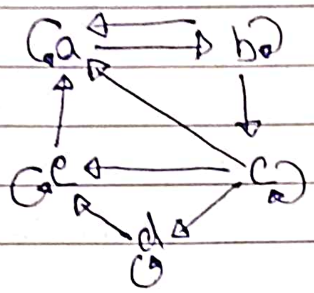
~~Degree of self loop is twice.~~

eg. R = { (1,2) (2,3) (3,4), (4,2) (3,1) (1,4) (2,2) (1,1), (3,3) (4,4) }
Draw the relation using Di-graph.

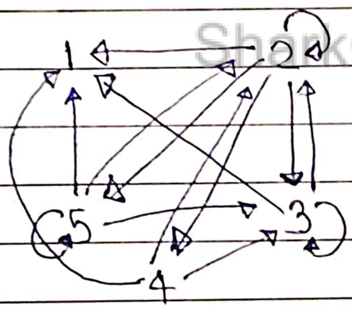


Degree of vertex 1 = 3
" 2 = 4
" 3 = 3
" 4 = 4.

e.g. $R = \{(a,b), (b,c), (c,d), (d,e), (e,a), (b,a), (c,a), (c,e), (a,a), (b,b), (c,c), (d,d), (e,e)\}$.



Q. If set $A = \{1,2,3,4,5\}$ & $R = \{(2,2), (2,4) (2,5), (2,3) (2,1) (3,1), (3,3) (3,2) (4,1) (4,2) (4,3) (5,1) (5,2) (5,3) (5,5)\}$
Draw the di-graph of R.



Properties of Relation

1) Reflexive relation: A relation R on set A is called reflexive if $\forall$ $a \in A$ is related to aRa holds

e.g. 1. $R = \{(a,a) (b,b) (c,c)\}$ on set $A = \{a,b,c\}$ is Reflexive.

2. $R = \{(a,b), (a,c), (b,b), (c,c) (a,a)\}$.
So R is reflexive, bcoz $(a,a), (b,b), (c,c) \in R$.

2) Irreflexive relation: A relation R on set A is called irreflexive if No $a \in A$ is related to aRa or bRb.

e.g. 1) R = {(a,b) (b,c) (a,b)}.
on set A = {a,b,c} is Irreflexive.

2) R = {(a,b) (b,a) (a,a)} is irreflexive or not?

Ans – R is not irreflexive bcoz (a,a) ∈ R.
R is not reflexive too.

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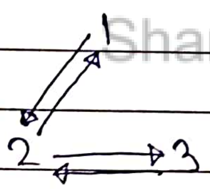
3) Symmetric Relation

A relation R on set A is said to be symmetry if xRy implies yRx

i.e $xRy \rightarrow yRx$.

i.e $\forall x \in A$ & $\forall y \in A$

e.g. 1) R = {(1,2) (2,1) (2,3) (3,2)}
on set A = {1,2,3} is symmetric.



e.g. 2) R = {(a,b) if a|b}. on set A = {1,2,3,4} is this symmetric or not. R = {(1,1) (1,2) (1,3) (1,4) (2,2) (2,4) (3,3) (4,4)}

Ans. No, This is non-symmetric R.
Since, (1,2) & (2,1) is not exists.
(1,3) & (3,1) ——— "
(1,4) & (4,1) ——— " ———
(2,4) & (4,2) ——— " ———

eg. 3) R = {(1,2) (1,3) (1,4) (2,1) (2,3) (2,4) (3,1) (3,2) (3,4) (4,1) (4,2) (4,3)} is symmetric or not?

Yes, it is symmetric R. $(a,b) \in R \rightarrow (b,a) \in R$.
Since, (1,2) & (2,1) exists
(1,3) & (3,1) exists

(1,4) & (4,1) exists
(2,3) & (3,2) exists
(2,4) & (4,2) exists.
(3,4) & (4,3) exists

4) Anti Symmetric Relation.

A relation R on set A is said to be Antisymmetric if xRy & $yRx \rightarrow (x=y)$
$\forall x \in A, \forall y \in A$.

e.g. $R = \{(x,y) \rightarrow N \mid x \leq y\}$ is Anti-Sym R.

Since,
$x \leq y$ & $y \leq x \longrightarrow x = y$

5) Transitive relation.

A relation is said to be transitive if xRy & yRz implies xRz

e.g. $R = \{(1,2)(2,3)(1,3)\}$ is transitive R

e.g. $R = \{(1,2)(2,1)(2,3)(3,2)(1,1)(2,2)(3,3)\}$.
is transitive or not?

Ans. Non-Transitive R.
Since $(1,2)$ & $(2,3) \in R$
but $(1,3)$ or $(3,1) \notin R$

Equivalence Relation.

A relation R is an equivalence relation if it is reflexive, symmetric and transitive.

e.g. $R = \{(1,1)(2,2)(3,3)(1,2)(2,1)(1,3)(3,1)(2,3)(3,2)\}$.

Check is Eq-Relaⁿ or not?

eg. 1: Let $A = \{\cancel{1,2,3,4}\}$ a, b, c, d
$R = \{(a,b) \text{ if } (a+b) \text{ is even}\}$

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Ist check R is E-R or not
I reflexive = a+a = 2a.
II Symmetric = a+b is even →
b+a is even.
III Transitive = a+b is even, b+c is even
→ a+c is even.
assume a=1, b=3, c=5.

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Ques A = {1, 2, 3, 4, 5}.
R = {(a,b) | a+b is even}.

Soln: Reflexive: {(1,1) (2,2) (3,3) (4,4) (5,5)}.
Symmetric: {(1,3) (3,1) (3,5) (5,3) (2,4) (4,2) (1,5) (5,1)}.
Transitive: {(1,3) (3,5) (1,5)} since, a=b, b=c → a=c.

Equivalence Class.
Equivalence class is denoted by [a] or [x]

eg. [x]: {y | y ∈ A & (x,y) ∈ R}
A = {1, 2, 3, 4, 5}
R = {(1,2) (2,1) (4,5) (5,4) (1,1) (2,2) (3,3) (4,4) (5,5) (4,3) (5,3)}

Soln: ~~[1] = {1, 2~~ for equivalence relation,
Reflexive = (1,1)
Symmetric = (1,2) (2,1)
Transitive = (4,5) (5,3) (4,3)
[1] = {1,2} taken from (1,2)(1,1)
[2] = {2,1} —— " —— (2,1) (2,2).
[3] = {3,3} —— " —— (3,3)
[4] = {4,5,3} —— " —— (4,5) (4,4)(4,3)
[5] = {5,4,3} —— " —— (5,4)(5,5) (5,3)

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Domain & Range
Dom(R) & Ran(R)

e.g. 1 $A = \{1, 2, 9\}$, $B = \{1, 3, 7\}$.
$R = \{(1,1), (3,3)\}$.

Soln: Dom $R = \{1, 3\}$
Ran $R = \{1, 3\}$.

e.g. 2 $R = \{(1,3) (1,7) (2,3) (2,7)\}$.
Dom $(R) = \{1, 2\}$
Ran $(R) = \{3, 7\}$

e.g. 3 $R = \{(2,1) (9,1) (9,3) (9,7)\}$
Dom$(R) = \{2, 9\}$
Ran$(R) = \{1, 3, 7\}$.

Lattice as Posets
Partially ordered sets. $(A, |)$

GLB = Meet = $\wedge$
LUB = Join = $\vee$

A partially ordered set $(A, |)$, is called a lattice, if every pair of elemnt a & b in L has both a least upper band (LUB) and greatest lower bound (GLB).
The LUB is also called Join of a & b and is denoted by $\vee$.
The GLB is also called Meet of a & b and is denoted by $\wedge$.

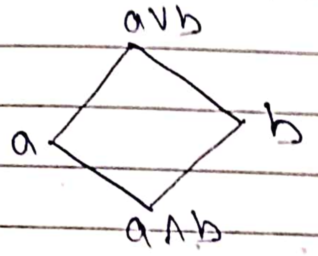
if $(L, \leq)$ is a lattice and $a, b, c, d \in L$, then the Meet & Join have following order properties.

1) $a \wedge b \leq \{a, b\} \leq a \vee b$
2) $a \leq b$ iff $a \wedge b$ (Meet)
3) $a \leq b$ iff $a \vee b = b$
4) if $a \leq b$ then, $a \wedge c \leq b \wedge c$ & $a \vee c \leq b \vee c$

5 $a \leq b$ & $c \leq d$ then

$a \wedge c \leq b \wedge d$

$a \vee c \leq b \vee d$



Partial Order Relation : ~~set A~~

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A relation R on set A is said to be partial order relation if it is reflexive, transitive & Anti-symmetric.

Hasse Diagram

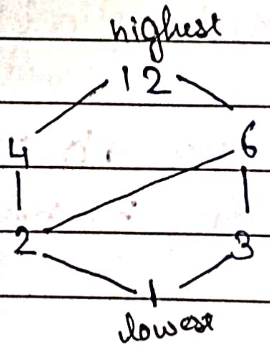
It is a graphical representation of a relation of an element of a partially ordered set with an implied upward orientation.

Eg: Draw a Hasse diagram for $(D_{12}, /)$. Find the maximum, minimal, greatest and least element.

Soln: Here, D_{12} means set of positive integers divisors of 12

so, $D_{12} = \{1, 2, 3, 4, 6, 12\}$

Poset A = { (2|1), (3|1), (4|1), (6|1), (12,1) } (1|1) }.
(4|2) (6|2) (12|2) (6|3) (12|3) (12|4) (12|6)
(2|2) (3|3) (4|4) (6|6) (12|12) }.



1) Reflexive = yes (1,1) (2,2)

2) Transitive = (12 R 4) (4 R 2) $\Rightarrow$ (12 R 2)

3) Antisymmetric = ×

x / y & y / x.

$1/6 \neq 6/1$

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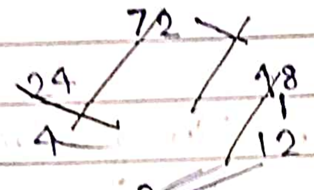
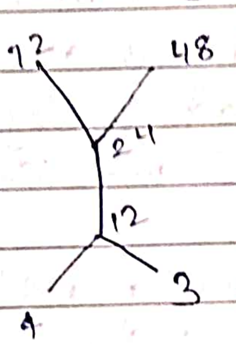
Q. $D = \{(3, 4, 12, 24, 48, 72), |\}$. Find maximum, minimal and greatest, lowest element



To find the POSET for divisibility

$A = \{(12|3), (24|3), (48|3), (72|3), (12|4),$
$(24|4), (48|4), (72|4), (24|12), (48|12),$
$(72|12), (48|24), (72|24)\}$



Ans • Minimal elements: numbers not divisible by any smaller no. i.e 3 & 4.

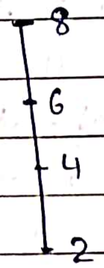
• Maximum elements: numbers not divisible by any larger no. i.e. 72.

Chain & Antichain

- Chain: A totally ordered subset of a partially ordered set A is called a chain. In short, every two elements are related.
- Antichain: A pair-wise incomparable subset is called an antichain. In short, no two elements are related.

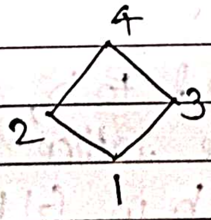
For example, Let $S = \{2, 4, 6, 8\}$ & $(S, \leq)$

Sol^n:



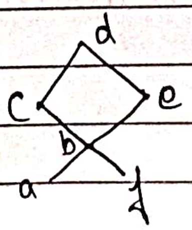
Chain = $\{2, 4, 6, 8\}$
Antichain = $\{$ No $\}$

e.g.



Chain = $\{1, 2, 4\}$ OR/AND = $\{1, 3, 4\}$.
Antichain = $\{2, 3\}$.

e.g.



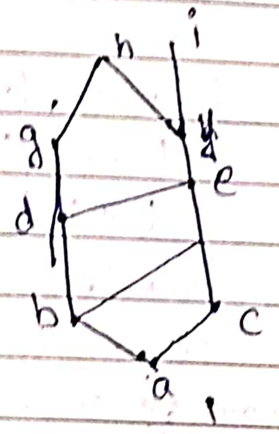
Chain = $\{a, b, e, d\}$
= $\{a, b, c, d\}$
= $\{f, b, c, d\}$
= $\{f, b, e, d\}$

Antichain = $\{a, f\}$
and / OR.
= $\{c, e\}$.

maximal element =

- Lattice

LUB – $\vee$ – Join } operation.
GLB – $\wedge$ – Meet }



Find the greatest upper bound and least ~~lower~~ upper bound of vertex {b,d,g}. If they exist in POSET with the hasse dia.

Sol^n Upperbound of vertices {b,d,g} are g and h, because b is related to g, g is related to g, d is related to g. Also, b is related to h, d is related to h and g is related to h.

Note: g is not related to f, bcz, they are antichain.
∴ f is not upperbound of {b,d,g}
Similarly, i is not upperbound of {b,d,g}

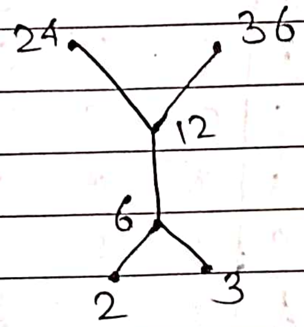
Least upperbound is the one which is related to every other upperbound.

g is related to h, but h is not related to g, so g is the least upper bound. Out of g and h, minimum element is g, therefore g is the least upperbound of {b,d,g}

Lower bounds of {b,d,g} are a and b. Out of a and b, greatest element is b. Therefore, b is greatest lower bound of {b,d,g}.

Since, every other lower bound related to b, a is related to b, b is not related to a, because lattice does not work in downward direction. Therefore, b is GLB.

Chain & Antichain



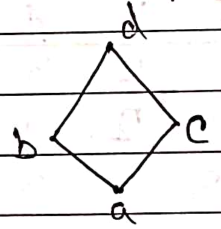
Find out maximal element
minimal,
greatest & least element.

$S = \{2, 3, 6, 12, 24, 36\}$

Maximal element : 24, 36.
Minimal element : 2, 3.
Greatest element : None
Lowest element : None.

Ques. Determine the following Hasse's diagram is a lattice or not ?

a.



LUB = Join

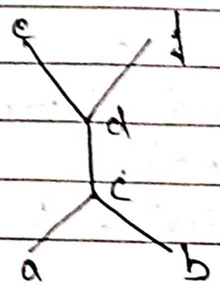
$\vee$	a	b	c	d
a	a	b	c	d
b	b	b	d	d
c	c	d	c	d
d	d	d	d	d

GLB = Meet

$\wedge$	a	b	c	d
a	a	a	a	a
b	a	b	a	b
c	a	a	c	c
d	a	b	c	d

Since, each subset of two elements have join and meet operations i.e. LUB & GLB respectively.
Hence, given Hasse-diagram is a lattice.

b.



LUB = Join

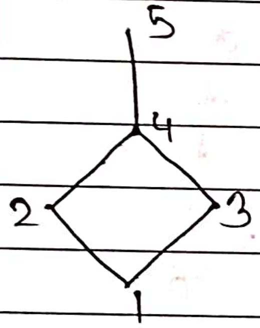
∨	a	b	c	d	e	f
a	a	c	c	d	e	f
b	c	b	c	d	e	f
c	c	c	c	d	e	f
d	d	d	d	d	e	f
e	e	e	e	e	e	–
f	f	f	f	f	–	f

GLB = Meet

∧	a	b	c	d	e	f
a	a	–	a	a	a	a
b	–	b	b	b	b	b
c	a	b	c	c	c	c
d	a	b	c	d	d	d
e	a	b	c	d	e	d
f	a	b	c	d	d	f

Since, e join f (e∨f) & (f∨e) does not exist & (a∧b) & (b∧a) does not exist, hence we cannot find out lower element as well as upper element in hasse diagram. Hence, this is not a lattice.

c.



LUB = Join

∨	1	2	3	4	5
1	1	2	3	4	5
2	2	2	4	4	5
3	3	4	3	4	5
4	4	4	4	4	5
5	5	5	5	5	5.

GLB = Meet.

∧	1	2	3	4	5
1	1	1	1	1	1
2	1	2	1	2	2
3	1	1	3	3	3
4	1	2	3	4	4
5	1	2	3	4	5.

~~Since (5∨5)~~

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Unit - 4

Graph Theory

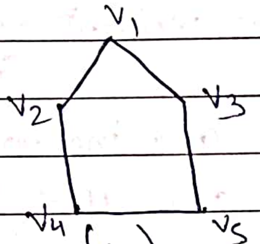
Adjacency & Incidence.

$V = v_1, v_2, v_3, \ldots$

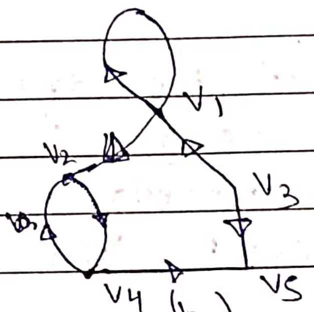
$E = e_1, e_2, e_3, \ldots$

G = Any graph

$A = [a_{ij}]_{n \times n}$.



(a)



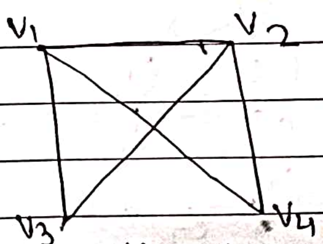
(b)

Vertex	Adjacency vertices
v_1	v_2, v_3
v_2	v_1, v_4
v_3	v_1, v_4, v_5
v_4	v_2, v_3, v_5
v_5	v_3, v_4

Vertex.	Adjacency.
v_1	$v_1\ v_2$
v_2	v_4
v_3	v_1, v_5
v_4	v_2, v_5
v_5.	

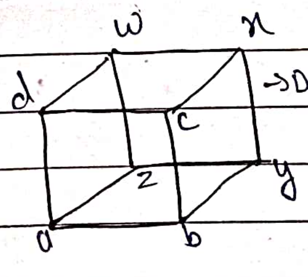
outgoing arrows consider.

Let $G(V, E)$ be a simple graph with n vertices ordered from v_1 to v_n, then the adjacency matrix $A = [a_{ij}]_{n \times n}$ of G is an $n \times n$ symmetric matrix defined by the elements.



Adja-Matrix.

$$\begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array} \begin{array}{c} \begin{array}{cccc} v_1 & v_2 & v_3 & v_4 \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$



→ Draw matrices

$$\begin{array}{c} \\ w \\ x \\ y \\ z \end{array} \begin{array}{c} \begin{array}{cccccccc} a & b & c & d & w & x & y & z \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & & & & & & & \\ & & & & & & & \\ & & & & & & & \end{bmatrix} \end{array}$$

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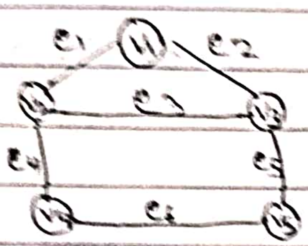


Adjacency matrix

	v1	v2	v3	v4	v5
v1	0	1	1	0	0
v2	1	0	1	1	0
v3	1	1	0	0	1
v4	0	1	0	0	1
v5	0	0	1	1	0

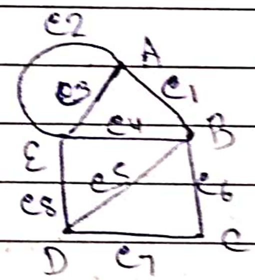
Incidence matrix: In a graph, two edges are incident if they share a common vertex.

For eg: Edge e_1, e_2 and edge e_1, e_3 are incident as they share the same vertex v_2, also we can define the incident over a vertex matrix.

A vertex is an incident to an edge if the vertex is one of the two vertices the age connects therefore an incidence is a pair of (v, e).

	e1	e2	e3	e4	e5	e6
v1	1	1	0	0	0	0
v2	1	0	1	1	0	0
v3	0	1	1	0	1	0
v4	0	0	0	1	0	1
v5	0	0	0.	0	1	1

Handshaking Theorem:



$\Sigma \deg(v) = 2 \times E$

$V = v_1, v_2, v_3, \ldots$

$E = e_1, e_2, e_3, e_4, e_5, e_6, e_7, e_8$

$\boxed{E = 8 \times 2 = 16}$

$\deg(A) = 3$

$\deg(B) = 4$

$\deg(C) = 2$

$\deg(D) = 3$

$\deg(E) = 4$

$\boxed{\Sigma \deg(v) = 16.}$

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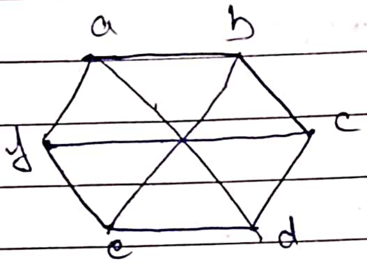
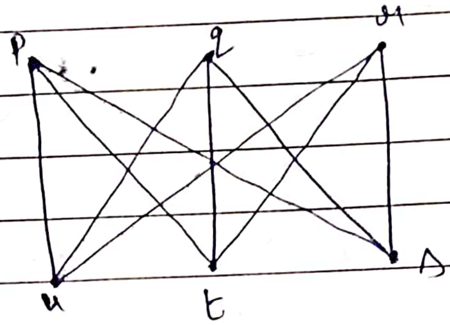
Isomorphic Graph:

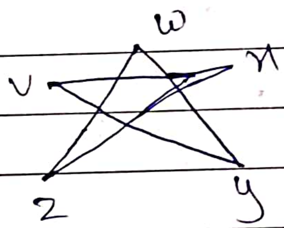


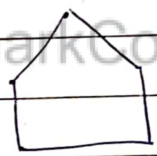
G_1



G_2

deg (a) = 3	deg (p) = 3
(b) = 3	deg (q) = 3
(c) = 3	(r) = 3
(d) = 3	(s) = 3
(e) = 3	(t) = 3
(f) = 3	(u) = 3





v = b = 2

w = a = 2

x = e = 2

y = d = 2

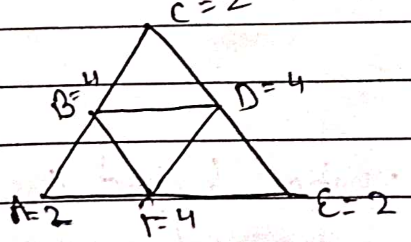
z = c = 2

30/09/25

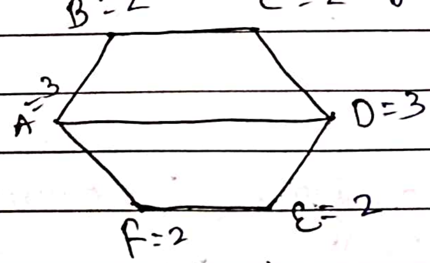
Euler Path and Circuit:

Euler path → Exactly two vertices have odd degree.

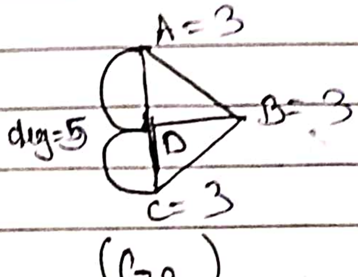
Euler circuit → Every vertex has even degree.



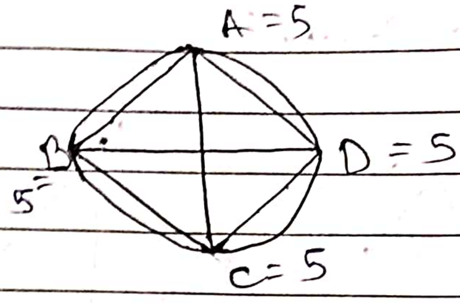
(G_1) Euler circuit.



(G_2) Euler path



(G3)

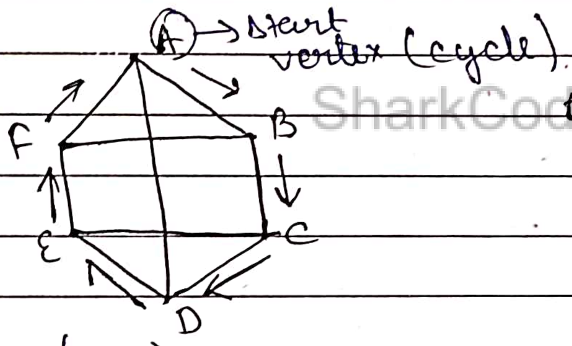


Neither Euler Path nor circuit.

Hamilton Path & Circuit

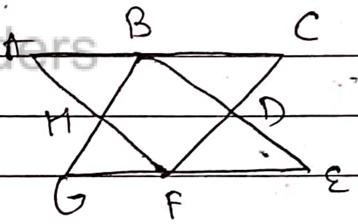
Hamilton graphs focus on vertices, we can only visit a vertex exactly once.

Hamilton path traverses every vertex ~~except~~ exactly once and Hamilton circuit (cycle) traverses every vertex once and start and end at the same node.



(G5)

H-ckt.



Neither Euler path nor ckt.

G6 – Neither H path nor circuit

4/10/25 Dijkstra Algorithm

Step. 1

Source vertex = A

$\boxed{A = 0}$ (zero)

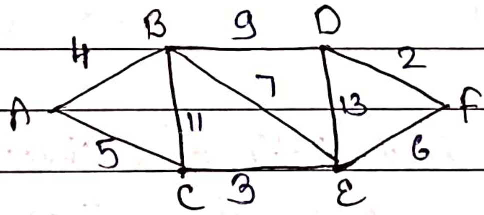
$B = \infty$

$C = \infty$

$D = \infty$

$E = \infty$

$F = \infty$



Step. 2 Distance from A to other vertices & find the nearest distance (S.P.A)

$\boxed{A-B=4}$

$A-C=5$

$A-D=\infty$

$A-E=\infty$

$A-F=\infty$

Step. 3: SP from A to B = 4.

Dist. from B (source vertex)

$B-C=11$

$B-D=9$

$B-E=7$

$B-F=\infty$

Step. 4:

SP from A-B-E consider source vertex = E

$E-D=13$

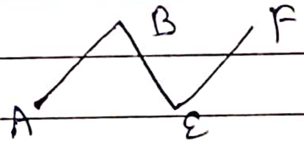
$\boxed{E-F=6}$

$E-C=NA$.

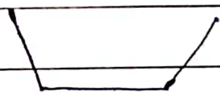
Step. 5:

Here we have reached the final vertex i.e. F. The S.P. A for the given graph is

$A-B-E-F = 4+7+6 = 17$

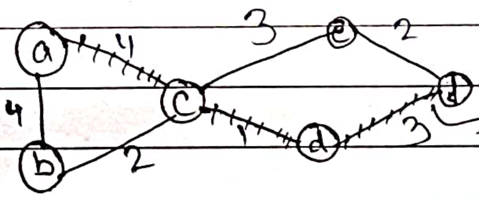


Since, This is not the shortest path.



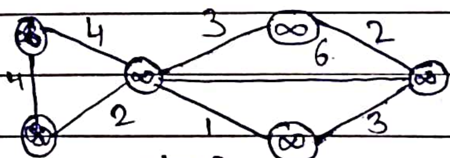
→ shortest distance.

Example 2 It is easier to start with an example and then think about the algorithm.



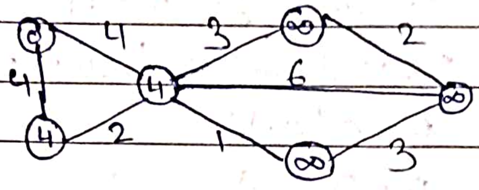
→ shortest route.

Start with a weighted graph.



Step. 2.

Choose a starting vertex and assign infinity path values to all other devices.



Step.3: Go to each vertex and update its path length.

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Chapter - 5

Trees

* Minimum Spanning Tree

1 ques. { 1. Prim's Algo (vertex)
2. Kruskal's Algo (Edge)

* Binary Tree Traversal:

1. Pre-order Traversal
2. In-order - T
3. Post-order - T

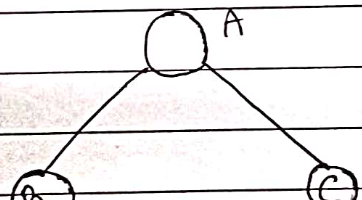
Binary Tree Traversal:

1. Pre-Order Traversal: i) Visit the root of the tree
ii) Traverse the left sub-tree in pre-order
iii) Traverse the right sub-tree in pre order.

2. In-Order-Traversal: ~~X~~ It is also a recursive proces

i) Traverse in in-order the left sub-tree
ii) Visit the root of the tree.
iii) Traverse the right sub-tree in in-order.

3. Post-order-Traversal: i) Traverse the left sub-tree
ii) Traverse the right sub-tree
ii) Visit the root of the tree.

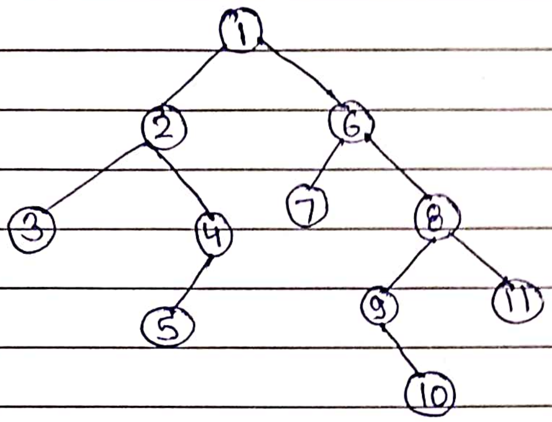


B - T

1) Pre ~~In~~-order: A → B → C
2) In-order: B → A → C
3) Post-order: B → C → A.

Binary Tree Traversal

Determine the preorder, postorder and inorder traversal of the binary tree shown in the given diagram.



a. Visit Root
b. Traverse left subtree
c. Traverse Right subtree

in preorder

1. Preorder

Root 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

2. In-order Traverse

3, 2, 5, 4, 1, 7, 6, 9, 10, 8, 11.

Root

3. Post-Order Traverse.

3, 5, 4, 2, 7, 10, 9, 11, 8, 6, 1 Root

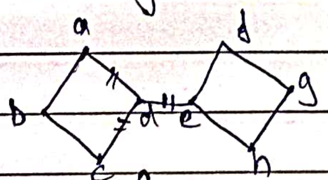
H.W. Draw a Binary Tree for Inorder & Postorder.

Inorder - 4-6-10-12-8-2-1-5-7-11-13-9-3

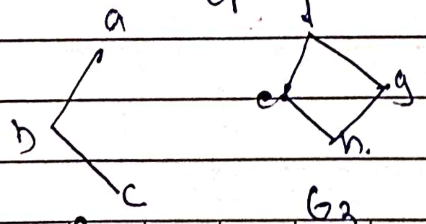
Postorder - 12-10-8-6-4-2-13-11-9-7-5-3-1

→ cut sets

Cut Vertex: By removing the connections from vertex d or e. the graph will become a disconnected graph. This represents a cut vertex.



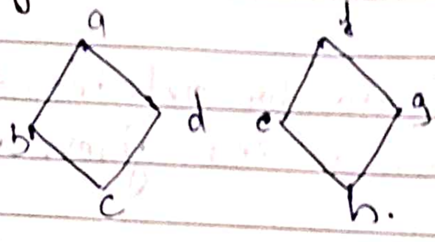
G_1



G_3

G_2.

Cut Edge.



removing the connections from edge d ad to e.