DISCRETE STRUCTURE ASSIGMENT 3

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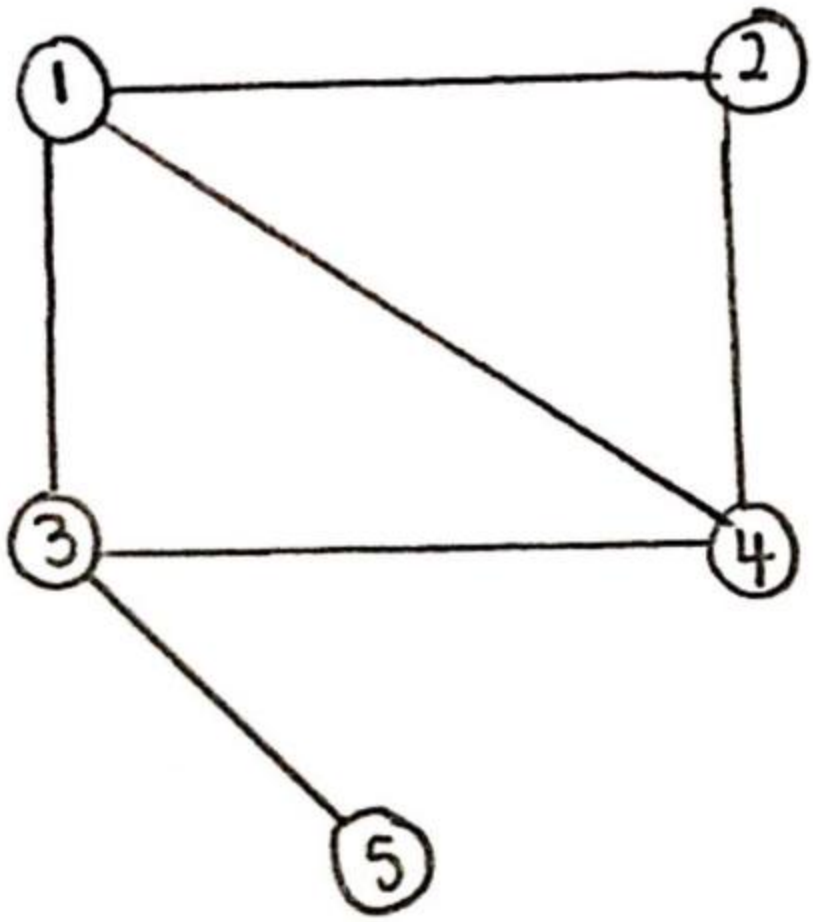
Question 1



Question 2

a) Incidence matrix

	a	b	c	d	e	f	g	h	i	k
1	1	1	1	1	0	0	0	0	0	0
2	0	0	0	0	1	0	0	0	0	0
3	1	0	1	0	0	1	1	1	0	0
4	0	0	1	0	1	1	0	1	0	0
5	0	0	0	0	0	0	1	0	1	0
6	0	0	0	0	0	0	1	0	1	1

b) Adjacency matrix

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

Question 3

- count the vertices

  Y = 6 vertices

  Z = 6 vertices

- count the edges

  Y = 9 edges

  Z = 9 edges

- degree of each vertex

  Y = 2 vertices having degree of 2, 2 vertices having degree of 3 and 2 vertices having degree of 4

  Z = 2 vertices having degree of 2, 2 vertices having degree of 3 and 2 vertices having degree of 4.

- Define the incident function, f : f ⟶ H,

  Y = { A, B, C, D, E, F }

  Z = { 1, 2, 3, 4, 5, 6 }

  f(A) = 1, f(B) = 2, f(C) = 3, f(D) = 4, f(E) = 5, f(F) = 6

= Graph Y and Graph Z are isomorphic

$A_Y =$

	A	B	C	D	E	F
A	0	1	0	1	0	0
B	1	0	0	1	1	1
C	0	0	0	1	1	1
D	1	1	1	0	0	1
E	0	1	1	0	0	0
F	0	1	1	1	0	0

$A_Z =$

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

Question 4

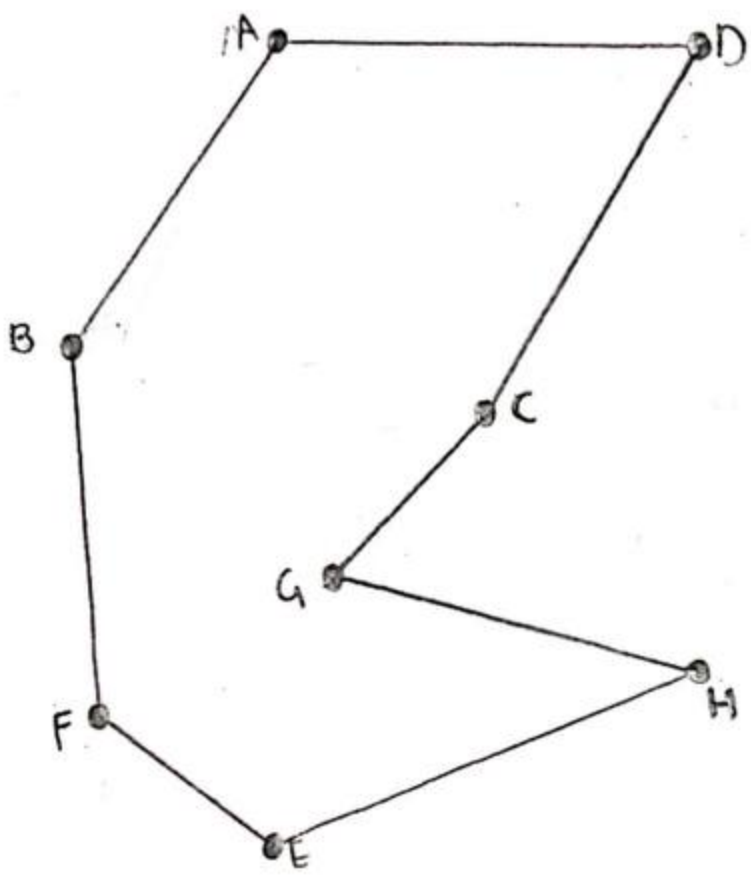
vertex	1	2	3	4	5	6
degree	3	2	4	6	3	2

= The graph has an Euler trail

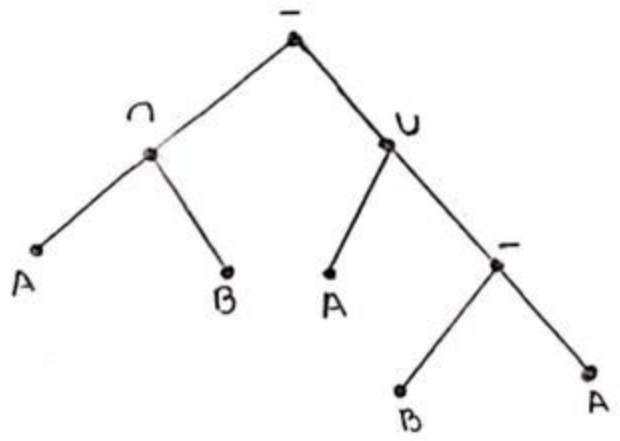
= The graph does not have Euler circuit because 2 vertices (v_1 and v_5) has odd degree, and all other vertices of the graph have positive even degree.

Question 5

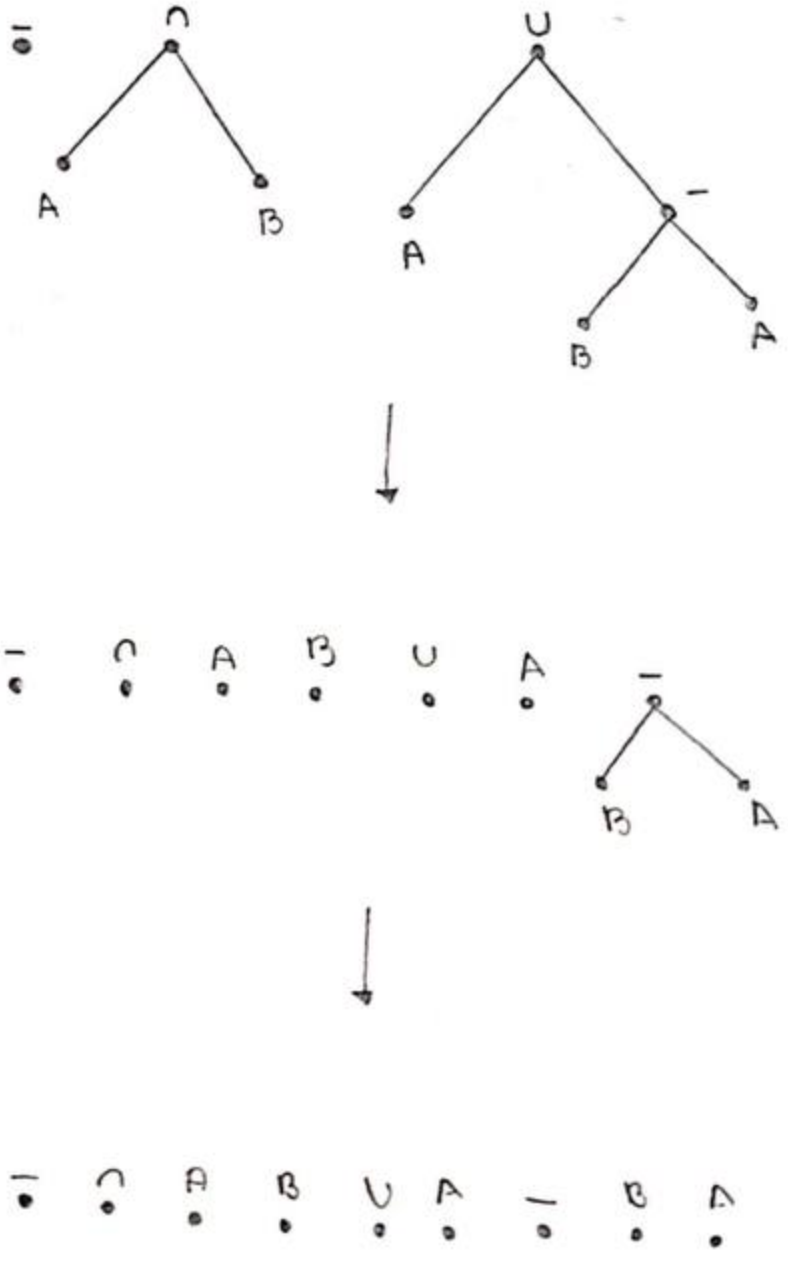
- The graph above has Hamiltonian circuit



Question 6

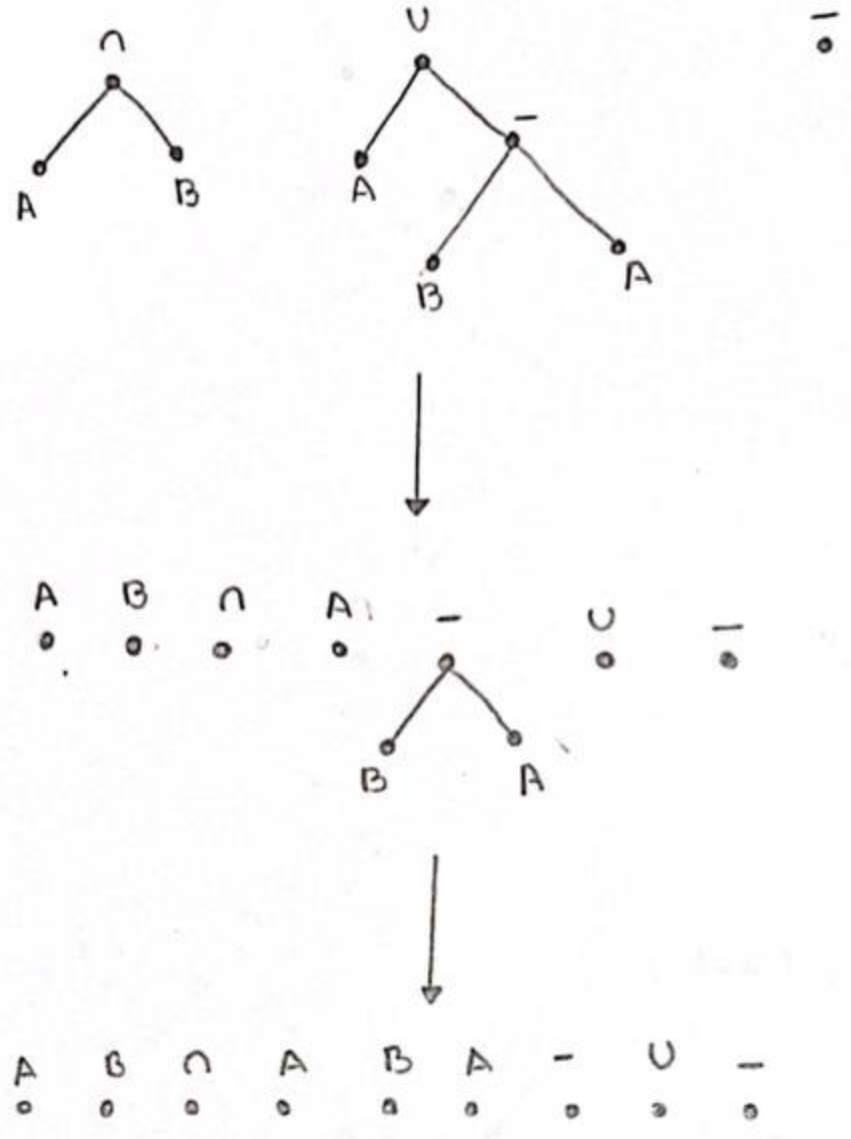


a)



prefix notation = − ∩ A B ∪ A − B A

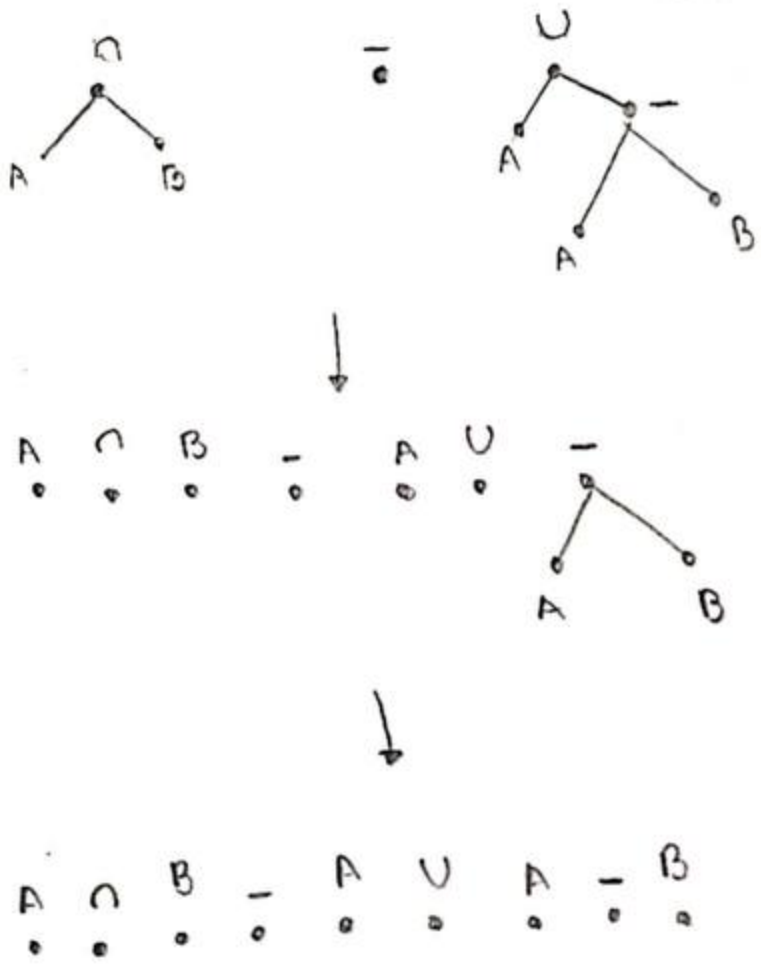
b)



postfix notation

= AB ∩ ABA − ∪ −

c)



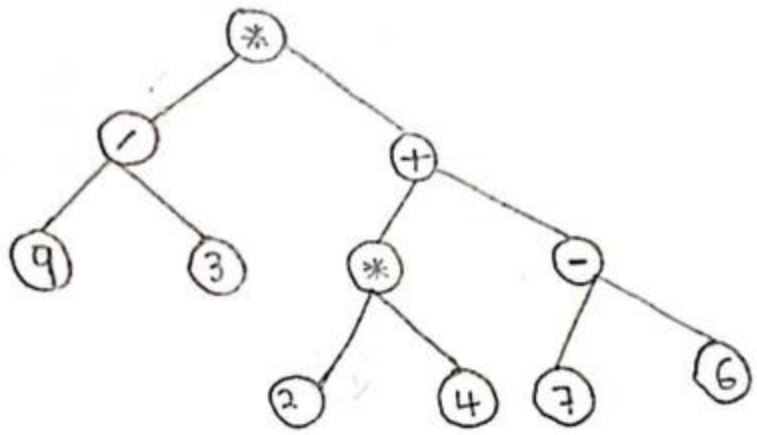
infix notation

= A ∩ B − (A ∪ (A − B))

Question 7

* / 93 + * 24 - 76

a)



b) infix notation = ((9/3) * ((2*4) + (7-6)))

c) = (9/3) * ((2*4) + (7-6))

= 3 * (8 + 1)

= 3 * 9

= 27

Question 8

a) children of vertex j

= n, o, p

b) ancestor of vertex s

= m, i, d, b, a

c) siblings of vertex q

= r, s, t

d) the number of leaves in rooted tree

= 4 + 3 + 3 + 1

= 11

e) level 3 vertices in this rooted tree

= h, i, j, k, l

f) least m for which this tree is a rooted m-ary tree

m = 4 because m has 4 children and no other vertex has more than 4 children

g) height of this rooted tree

h = 5

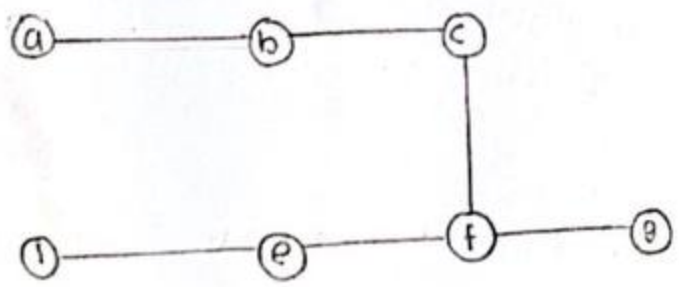
h) the postorder and inorder traversal for this rooted tree

postorder = h, q, r, s, t, m, i, d, e, b, n, o, p, j, f, k, l, g, c, a

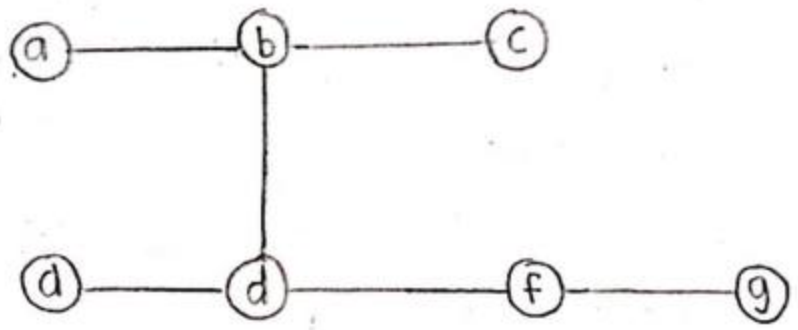
inorder = h, d, q, m, r, s, t, i, b, e, a, n, j, o, p, f, c, k, g, l

Question 9

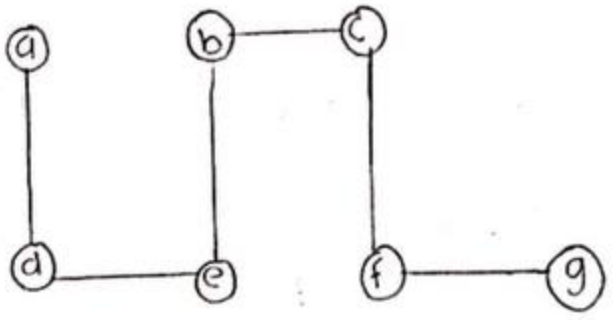
1)



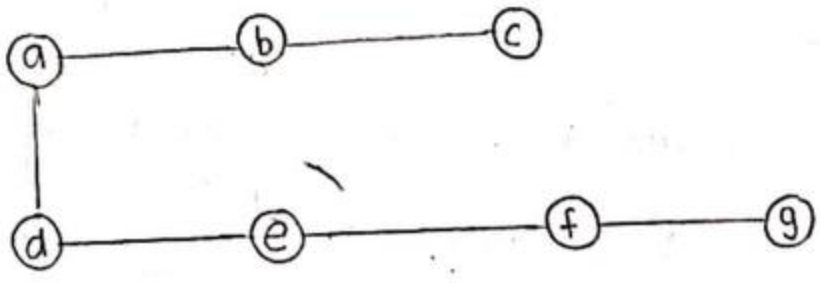
2)



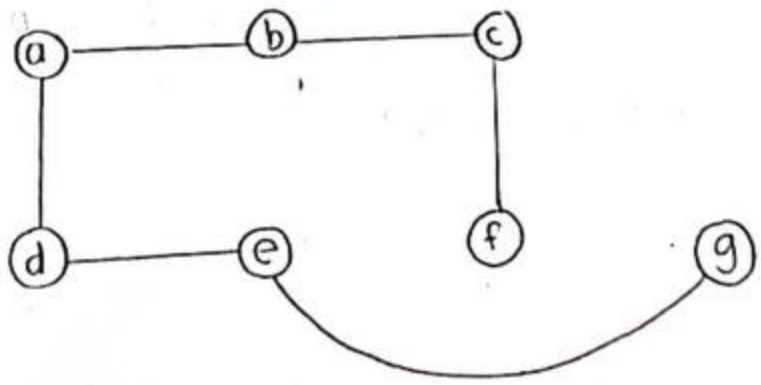
3)



4)

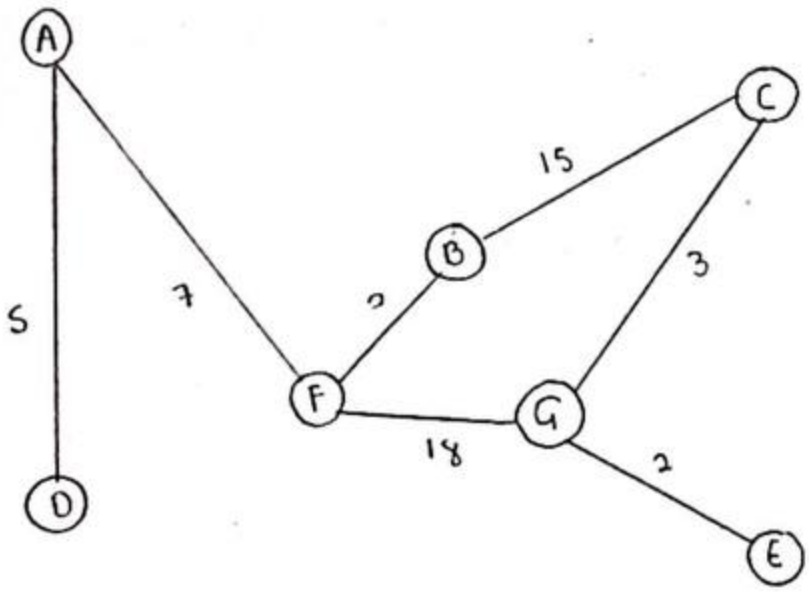


5)



Question 10

BF	EG	CG	CE	AD	AF	DF	AB	GC	EF	FG	BG	ED
2	2	3	4	5	7	13	14	15	15	18	19	22



Edge considered	Weight	Function take
BF	2	Added
EG	2	Added
CG	3	Added
CE	4	Not Added
AD	5	Added
AF	7	Added
DF	13	Not Added
AB	14	Not Added
BC	15	Added

Total minimum weight

= 2 + 2 + 3 + 5 + 7 + 15

= 34

Question 11

a) $p = n - 1$

$$n = \frac{(ml - 1)}{m - 1} = \frac{604}{4} = 151$$

$n = 151$

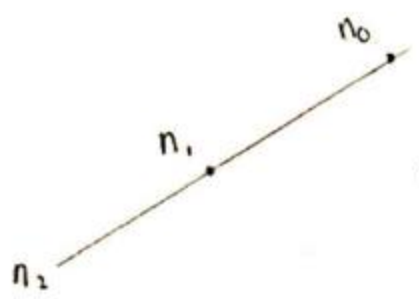
b) $n = mi + 1$

$= (7 \times 121) + 1$

$= 848$

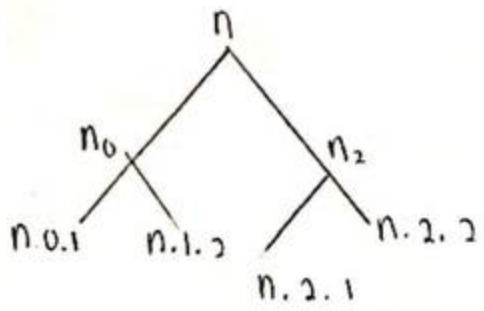
c) T - binary tree of heights

smallest tree formed when all nodes only have 1 child



number of nodes = 3

largest tree formed when all nodes have 2 children



number of nodes = 7

∴ The largest number of nodes T can have is 7, while the smallest number of nodes is 3.

d) Game round of tournament = height of tree formed = 5

Binary tree, single = elimination format

No of games in 1st round = 16

Max no if teams that can be registered

= 16 x 2

= 32

Num of matchs that need to be scheduled by the organiser = 2^{n-1} (number of nodes in tree)

$= 2^{n-1}(5)$

$= 2^{n-5}$

$= 31$

Question 12

DB	DE	CD	AC	CE	DF	EF	CB	AB
2	2	3	5	6	8	9	10	18

Iteration	S	N	L(A)	L(B)	L(C)	L(D)	L(E)	L(F)
0	{}	{A,B,C,D,E,F}	0	∞	∞	∞	∞	∞
1	{A}	{B,C,D,E,F}	0	18	5	∞	∞	∞
2	{A,C}	{B,D,E,F}	0	15	5	8	11	∞
3	{A,C,D}	{B,E,D}	0	10	5	8	10	16
4	{A,B,C,D}	{E,F}	0	10	5	8	10	16
5	{A,B,C,D,E}	{F}	0	10	5	8	10	16
6	{A,B,C,D,E,F}	{}	0	10	5	8	10	16

Shortest length = 16

Shortest path = A → C → D → F