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Maths Assignment - 4

Q.1)

Given set $S = \{a, b, c\}$

Power set $P(S)$ of set S will be;

$P(s) = \{\phi, \{a\}, \{b\}, \{c\}, \{a,b\}, \{b,c\}, \{a,c\}, \{a,b,c\}\}$

Relation $\subset$:

$\Rightarrow [(\{a\}, \{a,b\}), (\{b\}, \{a,b\}), (\{c\}, \{a,c\}),$
$(\{a\}, \{a,b,c\}), (\{b\}, \{b,c\}), (\{b\}, \{a,b,c\}),$
$(\{c\}, \{a,c\}), (\{c\}, \{b,c\}), (\{c\}, \{a,b,c\}),$
$(\{a,b\}, \{a,b,c\}), (\{a,c\}, \{a,b,c\}), (\{b,c\}, \{a,b,c\})$
$(\{a\}, \{a\}), (\{b\}, \{b\}), (\{c\}, \{c\}), (\{a,b\}, \{a,b\})$
$(\{a,c\}, \{a,c\}), (\{b,c\}, \{b,c\}), (\{a,b,c\}, \{a,b,c\})$

The relation above is reflexive i.e $\forall a \in A$, $(a,a) \in R$, anti-symmetric $\forall a, b \in A (a,b) \in R$, $(b,a) \in R$, $a = b$ and transitive i.e. $\forall a, b \in A$ $(a,b)(b,c) \in R$ then $(a,c) \in R$. Therefore, it is a Partial order relation as $P(S)$ is a Power set of S.

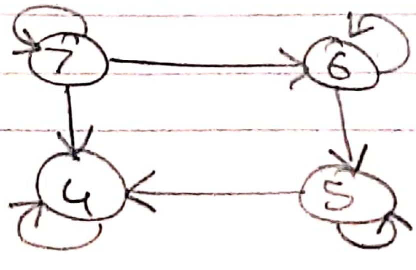
Q.2) ~~Ly~~ Given:

$A = \{4, 5, 6, 7\}$

Relation $\geq$ on n

$R = \{\{4,4\}, \{5,5\}, \{6,6\}, \{7,7\}, \{5,4\}, \{6,4\}, \{7,4\}, \{6,5\}, \{7,5\}, \{7,6\}\}$

Pictorial Representation:



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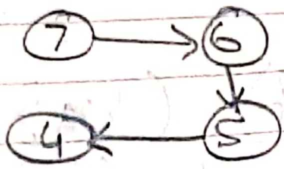
1.) Each element of Set A Represents vertex and arrow Represent relation

2.) For hass diagram, relation must be reflective, anti-symmetric and transitive, ∴ we don't need to represent self-loop and transitive relation.

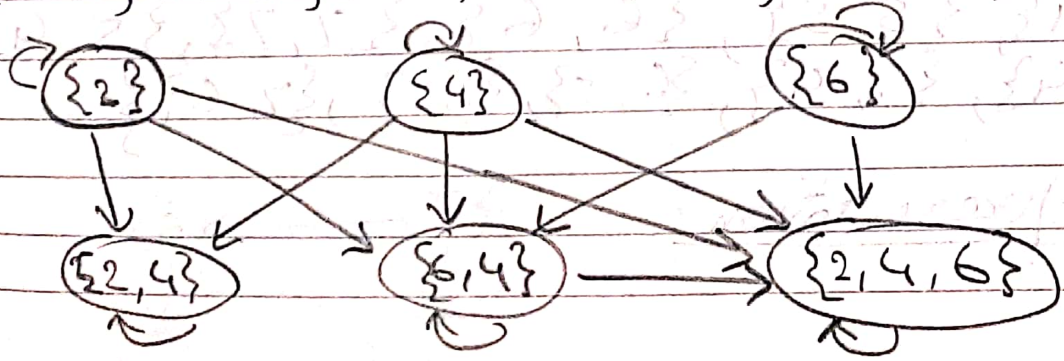


⇒ Hass diagram on R

Q.3 $A = \{\{2\}, \{4\}, \{6\}, \{2,4\}, \{6,4\}, \{2,4,6\}\}$

Relation "⊆"

[({2},{2}) ({4},{4}), ({6},{6}), ({2}, {2,4}), ({2,4},{2,4}),
({4}, {4,6}), ({2,4,6}, {2,4,6}), ({2},{2,4,6}),
({4},{2,4}), ({4},{6,4}), ({4},{2,4,6}),
({6},{6,4}), ({6},{2,4,6}), ({2,4},{2,4,6})



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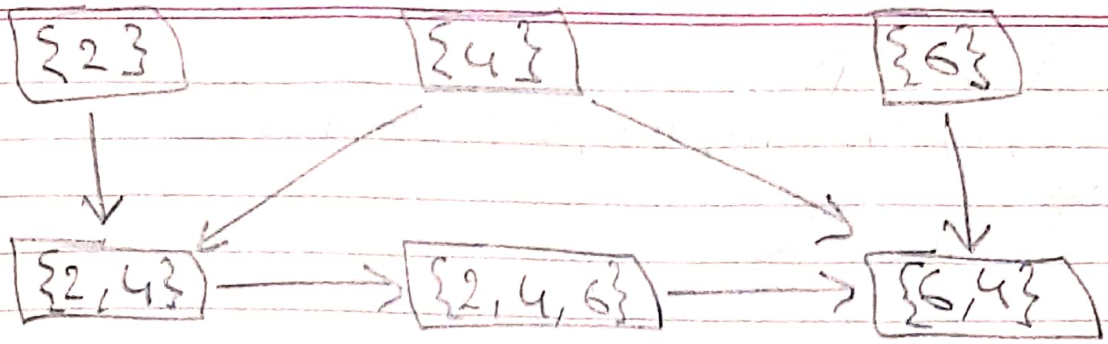
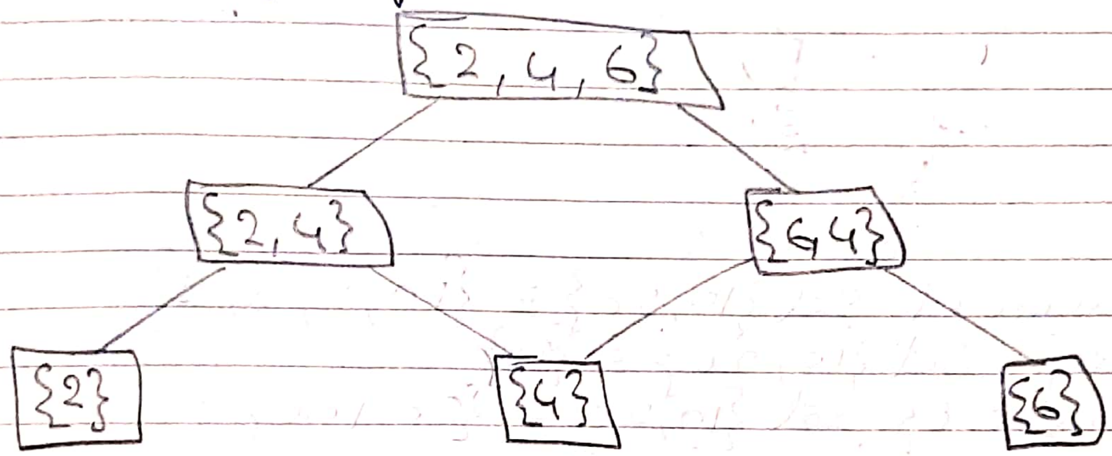
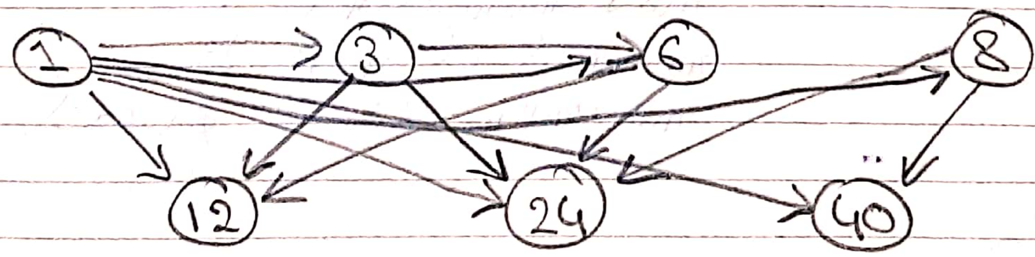


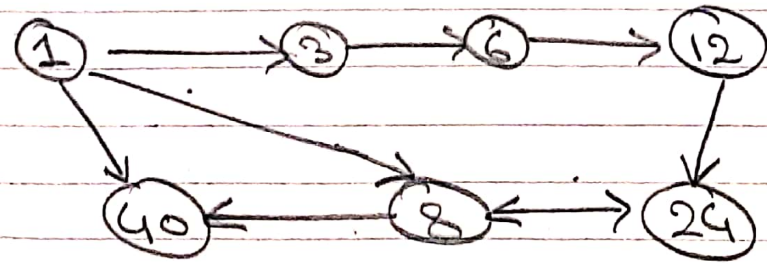
Hasse diag. of A:

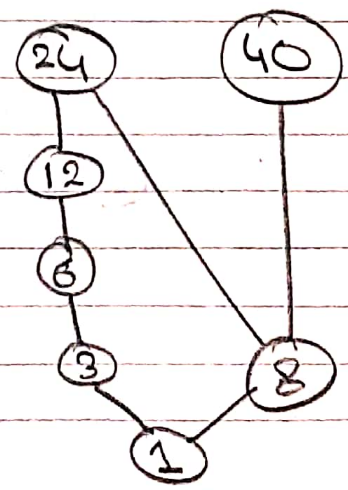


Q.4) $A = \{1, 3, 6, 8, 12, 24, 40\}$

$R = \{(1,1)(3,3)(6,6)(8,8)(12,12)(24,24)(40,40)(1,3)(1,8)$
$(1,6)(1,12)(1,24)(1,40)(3,6)(3,12)(3,24)(6,12)$
$(6,24)(8,24)(8,40)(12,24)\}$







Hasse diag.

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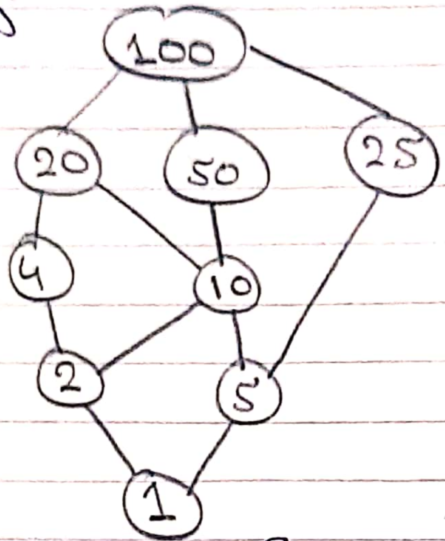
Q.6| Poset $(D_{100}, |)$

$D_{100} = \{1, 2, 4, 5, 10, 20, 25, 50, 100\}$

Hass diag.



Lower bound of set $\{10, 20\} = \{10, 2, 5, 1\}$

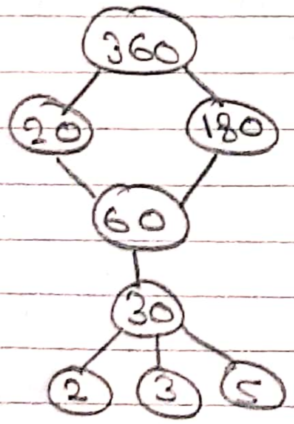
GLB of set $\{10, 20\} = \{10\}$

upper bound of set $\{10, 20\} = \{20, 100\}$

LUB of set $\{10, 20\} = \{20\}$

Q.7|

(A) Hass diag. of Poset $(S, |)$



maximal element = $\{360\}$

maximum element = $\{360\}$ greatest

minimal element = $\{2, 3, 5\}$

minimum element = ϕ (least)

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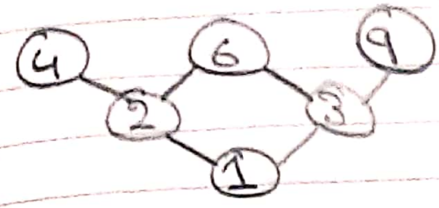
Q.7)

(B.) Hass diag. of Poset $(S, /)$



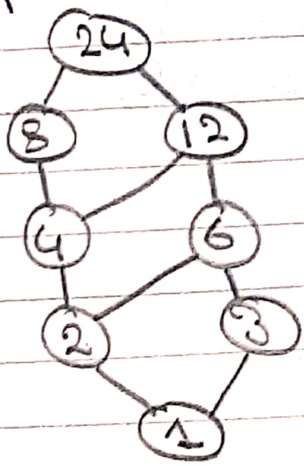
Maximal element $= \{4, 6, 9\}$
maximum element $= \phi$
minimal element $= \{1\}$
minimum element $= 1$

Q.8) Yes, it exist in the subset
$D = \{x : x \in Q \text{ and } 8 < x^3 < 15\}$

Here,
$G.L \wedge B$ = greatest element in lower bound
$L \vee B$ = lowest element in upper bound

Q.9) Hass diag for D_{24}

Complement lattice → If every element $\forall a \in L$ must have atleast one complement



Complement of $24 = 1$
$(1)^c = 24$
$(8)^c = 3$
$(3)^c = 8$
$(4)^c = \phi$

Therefore D_{24} is not a complement lattice

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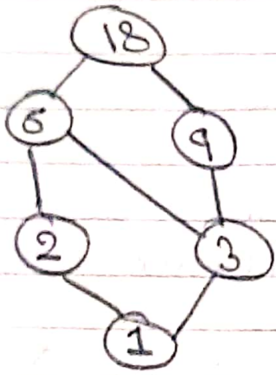
Q.10



This is an example of lattice, in distributive lattice, complement element if exists is unique i.e. each element has atmost one complemented lattice i.e. each element has atleast one compliment.

This eg. fails the condition of complimented lattice because element 6 has no compliment.