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Question 5 →

(b) $(Q \rightarrow P) \wedge (\neg P \wedge Q)$

(i) DNF → SOP

$= (\neg Q \vee P) \wedge (\neg P \wedge Q)$ (By implication, $A \rightarrow B = \neg A \vee B$)

$= [\neg Q \wedge (\neg P \wedge Q)] \vee [P \wedge (\neg P \wedge Q)]$

$= [(\neg Q \wedge \neg P) \wedge (\neg Q \wedge Q)] \vee [(P \wedge \neg P) \wedge (P \wedge Q)]$ (Distributive law)

$= [(\neg Q \wedge \neg P) \wedge F] \vee [F \wedge (P \wedge Q)]$

$(\because A \wedge F = F)$

we got the DNF, but if we solve further it is, $(F) \vee (F)$

$= F$

(ii) CNF → POS

$= (\neg Q \vee P) \wedge (\neg P \vee Q)$ ($\because$ By implication $A \rightarrow B = \neg A \vee B$)

$= [(\neg Q \vee P) \wedge \neg P] \wedge [(\neg Q \vee P) \wedge Q]$

$= [(\neg Q \wedge \neg P) \vee (P \wedge \neg P)] \wedge [(\neg Q \wedge Q) \vee (P \wedge Q)]$

(By distributive law)

$= [(\neg Q \wedge \neg P) \vee F] \wedge [F \vee (P \wedge Q)]$

[we know $A \vee F = A$]

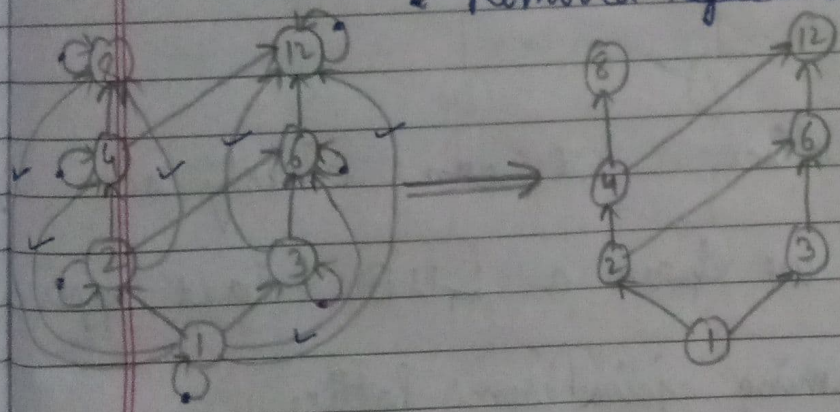
$\therefore \Rightarrow (\neg Q \wedge \neg P) \wedge (P \wedge Q)$

$= \neg Q \wedge Q \wedge \neg P \wedge P$

$=$ False (Ans)

(c) given, POSET $(\{1, 2, 3, 4, 6, 8, 12\}, |)$

Removed Reflexive (•) ones
& Removed Transitive (⤻) ones / Antisymmetric
(Not a lattice)



Reason:
for this to be a lattice it should be both meet semi lattice and join semi lattice, we see $12 \vee 8 = \phi$ or we can say that there is no least upper bound of $\{12, 8\}$ and hence, it can not form join semi lattice. ∴ ∴ It is not a lattice. Ans)

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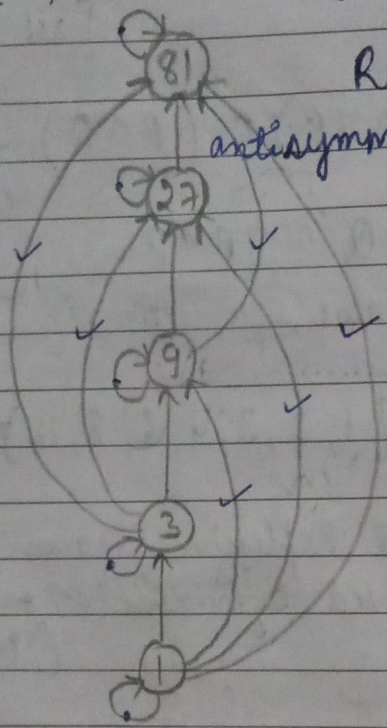
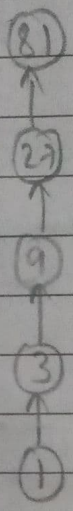
(a) Poset → ({1, 3, 9, 27, 81}, |)

⇒



Removing reflexivity, antisymmetry & transitivity, we get



Removed Reflexivity (•) ones,

Removed transitive (⌣) ones.

Yes, it is a lattice, we can clearly see for each pair we have a LUB (least upper bound), thus forming join semi lattice.

and for each pair, we have a GLB (greatest lower bound), thus forming meet semi lattice.

∴ It is a lattice (Ans)

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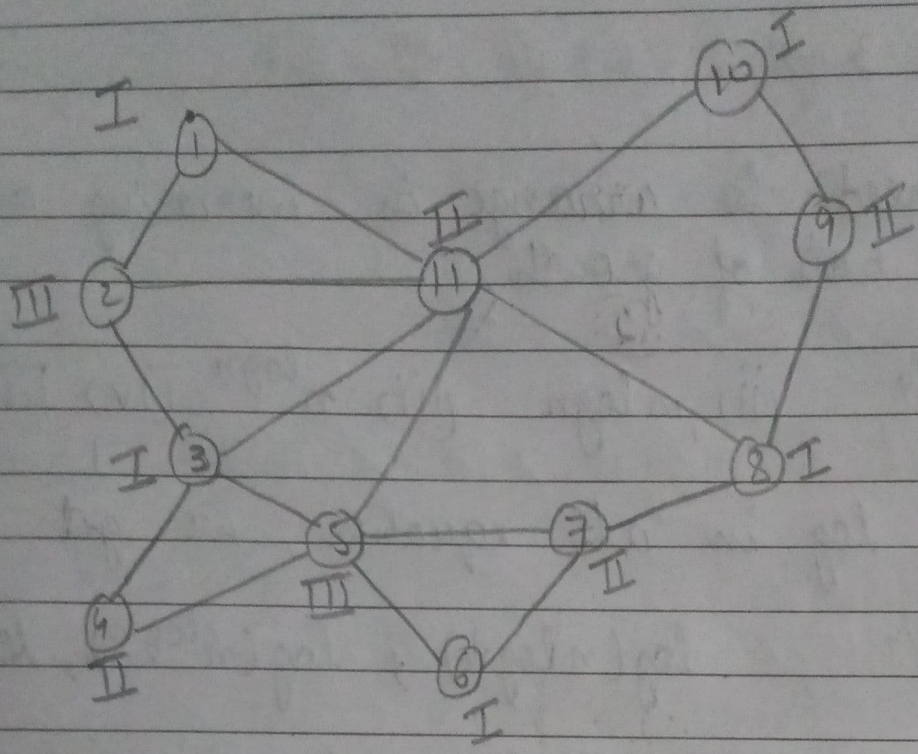
(a)



Consider, colors I, II, III; we see three colors are there that are enough to color them, and hence, we can say that no adjacent region has same color,

As it is 3 colorable then it is four colorable also

But chromatic no is minimum color required for graph coloring.

∴ chromatic no = 3. (Ans)