QNo3 (a)

i) $True \models \alpha$

It means α is valid. if it is true for all models.

$True \models \alpha$

This means it is true for all the interpretation. So α is valid.

e.g $\alpha = 2+2=4$.

this is true in every case., so it is valid.

ii) **False $\not\models \alpha$**

False means no model exist where something is true.

Proof: Since Entailment $A \models B$ means whenever A is true, B must also be true but False is never true in any model.

Conclusion: Nothing can follow from false.

iii)

α = It is raining

β = The ground is wet

$a \rightarrow \beta$

$\cancel{a \models \beta}$ → If it is raining, the ground is wet

$a \models \beta$ → It is raining entails, the ground is wet.

As both are true. so it is proved that if α entails β, then $\alpha \rightarrow \beta$ is also valid.

iv)

α = The square has 4 sides.

β = A shape with 4 equal sides and angles is a square.

These 2 things means the same thing in all models so both $\alpha \models \beta$ & $\alpha \Leftrightarrow \beta$ are valid.

v)

$\alpha \models \beta$ i

α = John is a bachelor.

β = John is un marrid.

if α is true, then β must also be true.

But if α is true and $\sim\beta$ is also true, this is contradiction.

Conclusion: Contradiction proves that entailment is valid.

(b)

i) if $\alpha \models \gamma$ or $\beta \models \gamma$, then $(\alpha \land \beta) \models \gamma$

α = It is raining

β = It is snowing.

γ = ground is wet.

→ If it is raining, then ground is wet ($\alpha \models \gamma$)

→ If it is snowing, then ground is wet $\beta \models \gamma$

But if it is both raining & snowing $(\alpha \wedge B)$, it does not mean ground is wet so counter example occurs.

ii) $\alpha \models (B \wedge \gamma)$, then $\alpha \models B$ & $\alpha \models \gamma$

↳ It means where α is true, both B & γ must be true.

↳ Individually must also be true

Conclusion: statement is true

iii) (d)

α = traffic light is red.

B = car stops

γ = car slows down.

if light is red then either car stops or slows down.

(But we don't) ✗

But this mean it necesserly stops or necessery slows down? No, we only know atleast one of them happens not which 1.

Artificial Intelligence:-

QNo4:-

$R_1 : \sim P_{1,1}$

$R_2 : (B_{1,1} \rightarrow (P_{1,2} \vee P_{2,1})) \wedge ((P_{1,2} \vee P_{2,1}) \rightarrow B_{1,1})$

$R_3 : (B_{2,1} \rightarrow (P_{1,1} \vee P_{2,2} \vee P_{3,1})) \wedge ((P_{1,1} \vee P_{2,2} \vee P_{3,1}) \rightarrow B_{2,1})$

$R_4 : \sim B_{1,1}$

$R_5 : B_{2,1}$

$R_6 : S_{1,2}$

$R_7 : \sim S_{1,1}$

$R_8 : (S_{1,2} \rightarrow (W_{1,3} \vee W_{2,2})) \wedge ((W_{1,3} \vee W_{2,2}) \rightarrow S_{1,2})$

~~Proof 1~~ $\cancel{\sim P_{1,2}}$

R2:

$\sim B_{1,1} \vee (P_{1,2} \vee P_{2,1}) \wedge (\sim (P_{1,2} \vee P_{2,1}) \vee B_{1,1})$

$(\sim B_{1,1} \vee (P_{1,2} \vee P_{2,1})) \wedge ((\sim P_{1,2} \wedge \sim P_{2,1}) \vee B_{1,1})$

$(\sim B_{1,1} \vee P_{1,2} \vee P_{2,1}) \wedge ((\sim P_{1,2} \vee B_{1,1}) \wedge (\sim P_{2,1} \vee B_{1,1}))$

R_3:

$$\sim B_{2,1} \vee (P_{1,1} \vee P_{2,2} \vee P_{3,1}) \wedge (\sim P_{1,1} \vee B_{2,1}) \wedge (\sim P_{2,2} \vee B_{2,1}) \wedge (\sim P_{3,1} \vee B_{2,1})$$

R_8:

$$(\sim S_{1,2} \vee W_{1,3} \vee W_{2,2}) \wedge (\sim W_{1,3} \wedge \sim W_{2,2} \vee S_{1,2}$$

$\cancel{\wedge (\sim W_{1,3} \vee)}$

$$\rightarrow (\sim S_{1,2} \vee W_{1,3} \vee W_{2,2}) \wedge (\sim W_{1,3} \vee S_{1,2}) \wedge (\sim W_{2,2} \vee S_{1,2})$$

i) By Inference rules

$\sim P_{1,2}$

$B_{1,1} \rightarrow (P_{1,2} \vee P_{2,1})$ —— (i)

$(P_{1,2} \vee P_{2,1}) \rightarrow B_{1,1}$ —— (ii)

$\sim B_{1,1}$ —— (iii)

By applying M.T in 2,3

$$\frac{(P_{1,2} \vee P_{2,1}) \rightarrow B_{1,1} \qquad \sim B_{1,1}}{\sim (P_{1,2} \vee P_{2,1})}$$

—— (iv)

By (iv)

$\sim(P_{1,2} \vee P_{2,1})$

$\sim P_{1,2} \wedge \sim P_{2,1}$ —— (v)

By applying AND-Elimination in (v) we get

$\sim P_{1,2}$

Hence Proved.

ii) $P_{3,1}$ (Inference Rules)

$B_{2,1} \rightarrow (P_{1,1} \vee P_{2,2} \vee P_{3,1})$

$(P_{1,1} \vee P_{2,2} \vee P_{3,1}) \rightarrow B_{2,1}$

$B_{2,1}$

$\sim P_{1,1}$

→ We cannot proof $P_{3,1}$ by these above rules. To prove we need $\sim B_{2,1}$ but this is not given in the rules. ~~so~~ it.

iii) $W_{1,3}$

$\cancel{\sim S_{1,2} \vee W_{1,3} \vee W_{2,2}}$

$\cancel{\sim W_{1,3} \vee S_{1,2}}$

$S_{1,2} \rightarrow (W_{1,3} \vee W_{2,2})$

$(W_{1,3} \vee W_{2,2}) \rightarrow S_{1,2}$

$S_{1,2}$

→ We cannot proof $W_{1,3}$ by these rules. To prove we need $\sim S_{1,2}$, which is not possible given in the rules

iv) $\sim P_{1,2}$ by Resolution theorem

$\sim B_{1,1} \vee P_{1,2} \vee P_{2,1}$

$\sim P_{1,2} \vee B_{1,1}$

$\sim P_{2,1} \vee B_{1,1}$

$\sim B_{1,1}$	given.	
$P_{1,2}$	given	
$P_{2,1}$	1,2	Res. theorem
$B_{1,1}$	3,6	Res. theorem

$\sim P_{2,1}$ 3, 4 Res. theorem

$\times$ 6, 8 Res. theorem.

Contradiction

So proved.

v)

$\sim S_{1,2} \vee W_{1,3} \vee W_{2,2}$

$\sim W_{1,3} \vee S_{1,2}$

$\sim W_{2,2} \vee S_{1,2}$

$S_{1,2}$

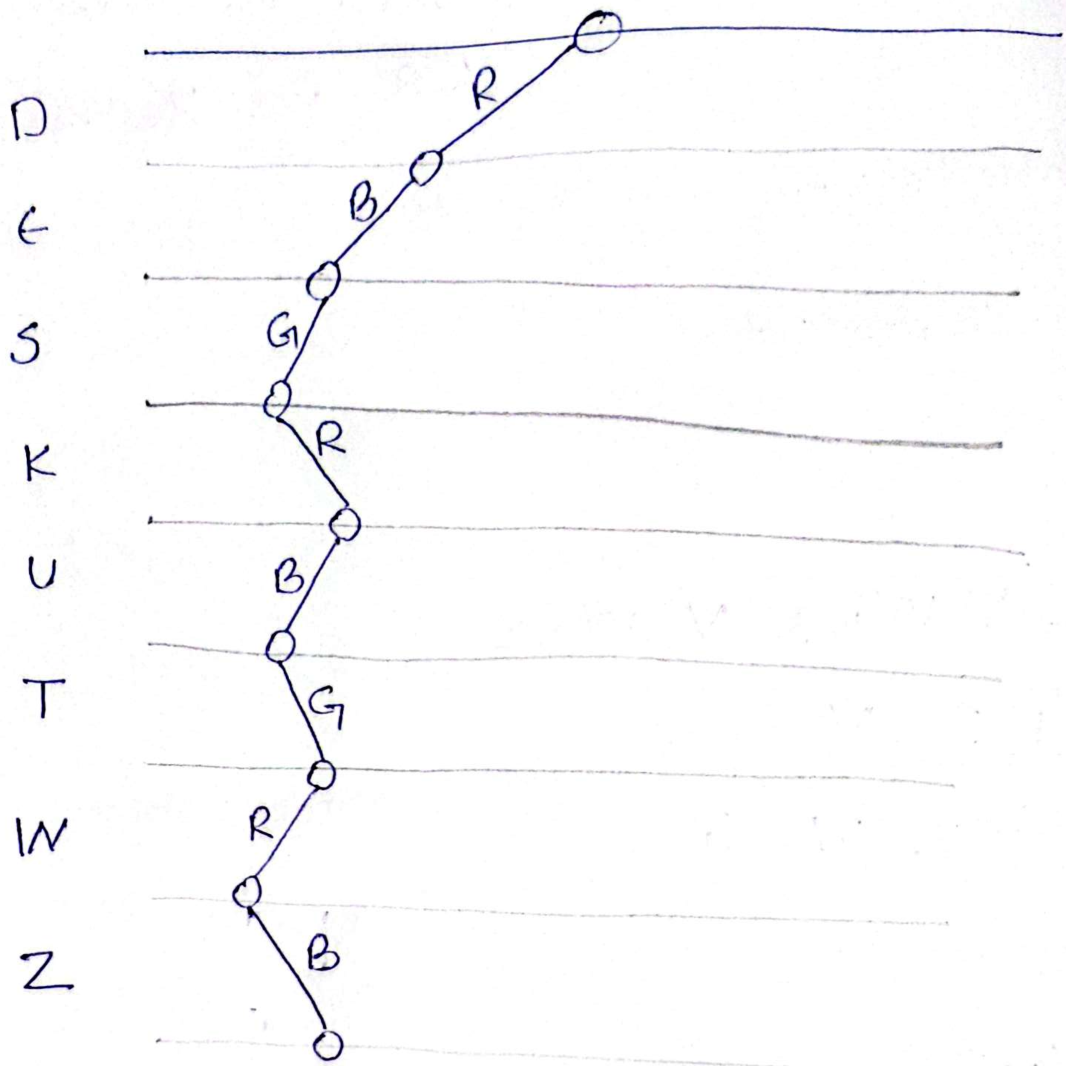
$\sim W_{1,3}$

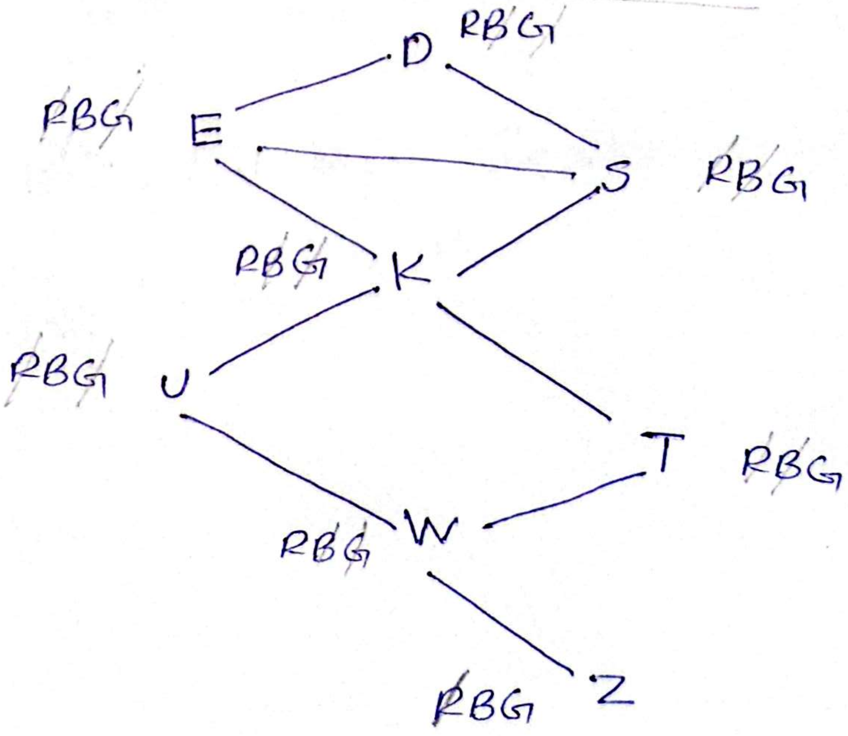
$W_{1,3}$ 1, 3 Res. theorem

$\times$ 5, 6 Res. theorem

iii)

QNo1 (b)





...01

(a)

House #	1	2	3	4	5
Persons	Norwegian	Ukrain	English	Spaniard	Japanese
Colors	Yellow	blue	Red.	ivory	green
Pet	fox	horse	snails	dog	zebra
Candy	Kitkat	Hershy Bars	smarties	Snickers	Milky Way
Drink	H_2O	tea.	Milk.	orange.	Cofee

zebra lives in green colour house with (and)^x Japanese. and drinks Water in a Norwegian House of yellow color.

~~QNo4~~:-

QNO2:

queue = { ~~(WA, NT)~~, ~~(WA, SA)~~, (NT, WA), ~~(NT, Q)~~
~~(NT, SA)~~ (SA, NT) ~~(SA, WA)~~ ~~(SA, Q)~~
~~(SA, NSW)~~ ~~(SA, V)~~ (Q, NT) ~~(Q, SA)~~
~~(Q, NSW)~~ ~~(NSW, Q)~~ (NSW, SA) (NSW, V)
(V, NSW), (V, SA), (NT, SA), (NT, WA), (NT, Q)
(Q, NT), (Q, SA), (Q, NSW), (Q, SA), (Q, NT)
(Q, NSW), (NSW, Q), (NSW, SA), (NSW, V) }

1) (WA, NT) → con.
2) (WA, SA) → cons.
3) (NT, WA) → cons.
4) (NT, Q) → cons.
5) (NT, SA) → incons.
6) (SA, NT) → cons.
7) (SA, WA) → cons.
8) (SA, Q) → cons
9) (SA, NSW) → cons
10) (SA, V) → cons.
11) (Q, NT) → incons
12) (Q, SA) → incons.
13) (Q, NSW) → cons.
14) (NSW, Q) → incons.
15) (NSW, SA) → Domain Empty

As domain becomes empty so no solution exists