

**I would like to use 1 extension day.**

Question 1:

- (a)  $H \Rightarrow W$
- (b)  $H \Leftrightarrow W$
- (c)  $L \Leftrightarrow H$
- (d)  $\neg W \Rightarrow \neg H$
- (e)  $R \vee W \Rightarrow H$

Question 2:

(a)  $S \Rightarrow S$

S	$S \Rightarrow S$
0	1
1	1

This is valid.

(b)  $S \Rightarrow C$ :

S	C	$S \Rightarrow C$
0	0	1
0	1	1
1	0	0
1	1	1

This is satisfiable.

(c)  $(S \wedge C) \vee (\neg F)$ :

S	C	F	$(S \wedge C) \vee (\neg F)$
0	0	1	1
0	0	0	0
0	1	1	1
0	1	0	0
1	0	1	1
1	0	0	0
1	1	1	1
1	1	0	1

This is satisfiable.

(d)  $(S \Rightarrow C) \Rightarrow (\neg S \Rightarrow \neg C)$ :

S	C	$(S \Rightarrow C) \Rightarrow (\neg S \Rightarrow \neg C)$
0	0	1
0	1	0
1	0	1
1	1	1

This is satisfiable

(e)  $((S \wedge C) \Rightarrow F) \Leftrightarrow (S \Rightarrow F) \vee (C \Rightarrow F)$ :

S	C	F	$((S \wedge C) \Rightarrow F) \Leftrightarrow (S \Rightarrow F) \vee (C \Rightarrow F)$
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

This is valid.

Question 3:

- (a) (2)  $\forall x \text{ GreenFood}(x) \Rightarrow \text{Delicious}(x)$   
(3)  $\forall x \neg \text{OrganicFood}(x) \Rightarrow \neg \text{HealthyFodLiver}(x)$   
(4)  $\forall x \neg \text{GreenFood}(x) \Rightarrow \neg \text{Recommend}(x)$   
(5)  $\exists x \text{ OrganicFood}(x) \Rightarrow \text{Delicious}(x)$

Question 4:

- (a) (i)  $\forall x \text{ lion}(x) \Rightarrow \text{carnivore}(x); \forall x \text{ tiger}(x) \Rightarrow \text{carnivore}(x); \forall x \text{ leopard}(x) \Rightarrow \text{carnivore}(x)$   
(ii)  $\forall x \forall y \text{ lion}(x) \wedge \text{offspring}(x,y) \Rightarrow \text{lion}(y)$   
(iii)  $\forall x \text{ lion}(x) \wedge \text{name}(x, \text{Simba}) \Rightarrow \text{lion}(\text{Simba})$   
(iv)  $\text{offspring}(\text{Simba}, \text{Sarani})$   
(v)  $\text{parent}(\text{Simba}, \text{Kion})$   
(vi)  $\forall x \forall y \text{ parent}(x,y) \Leftrightarrow \text{offspring}(y,x)$   
(vii)  $\forall x \text{ carnivore}(x) \Rightarrow \text{parentExist}(x)$