

(2)

(1)

Let  $x$  be a living things

$P(x)$ :  $x$  is a plant

$A(x)$ :  $x$  is an animal

$g$ : Joe's gold fish ( $\because$  Here discussing

$H(x)$ :  $x$  has a heart about particular person's fish

(1) Every living thing is a plant or animal  
not for all that is why we are not taking  $g(x)$ ]

$\forall x, P(x) \vee A(x)$ .

ii) Joe's gold fish is alive but not a plant

$\sim P(g)$  [ $\because P(x)$ : ~~is~~ is plant

but here gold fish is not

Plant ~~tree~~ ~~etc~~

if we write  $P(g)$  gold fish

is a living thing

we know that plant is a

living thing

$\therefore P(g)$  means gold fish  
is a plant

$\sim P(g)$  means gold fish is  
not a plant]

(iii) ① All Animals have a heart

②

$$\forall x, A(x) \rightarrow H(x).$$

Now: We have three statements.

$$\forall x, P(x) \vee A(x)$$

$$\sim P(g)$$

$$\forall x, A(x) \rightarrow H(x)$$

$$\therefore \text{Joe's gold fish has a heart} \equiv H(g).$$

here also we are not talking about  
all only Joe's gold fish have a  
heart means  $H$   
heart

$H(x)$  means  
 $H(g)$  means

$x$  has heart  
gold fish has heart

Now proof:

$$[(\forall x P(x) \vee A(x)) \wedge (\sim P(g)) \wedge (\forall x A(x) \rightarrow H(x))] \rightarrow H(g).$$

Solve L.H.S to get R.H.S:

$$[\forall x, P(x) \vee A(x)] \wedge [\neg P(g)] \wedge [\forall x, A(x) \rightarrow H(x)]$$

(3)

We know that  $P \rightarrow Q \Leftrightarrow \neg P \vee Q$

for  $P \vee Q \Leftrightarrow \neg P \rightarrow Q$

$$\therefore P(x) \vee A(x) \Leftrightarrow \neg P(x) \rightarrow Q(x)$$

$$[\forall x, \neg P(x) \rightarrow Q(x)] \wedge [\neg P(g)] \wedge [\forall x, A(x) \rightarrow H(x)]$$

Write third value in the second place

$$[\forall x, \neg P(x) \rightarrow A(x)] \wedge [\forall x, A(x) \rightarrow H(x)] \wedge (\neg P(g))$$

We know that  $(P \rightarrow Q) \wedge (Q \rightarrow R) \Leftrightarrow P \rightarrow R$

$$[\forall x, \neg P(x) \rightarrow H(x)] \wedge [\neg P(g)]$$

We have  $x$  is a living thing

$g$  is Joe's Gold fish

We know that Gold fish is also living

thing so in place of  $x$  we

can write  $g$  [Rule of universal specification]

$$\# [\neg P(g) \rightarrow H(g)] \wedge [\neg P(g)]$$

Wrong  $(P \rightarrow Q) \wedge P \not\Rightarrow Q$ .

$\rightarrow H(g)$ .