

Q1. Write FOL of the following?

→ ① Mary love everyone.

→ $\forall x \text{ loves}(\text{mary}, x)$

2) Mary love everyone

→ $\forall x \text{ love}(\text{mary}, x)$

3) No one talks

→ $\neg \exists x \text{ talks}(x)$

4) Everyone loves himself

→ $\forall x \text{ love}(x, x)$

5) Everyone love everyone

→ $\forall x \forall y \text{ loves}(x, y)$

6) Everyone loves everyone except himself

→ $\forall x \forall y (x \neq y \rightarrow \text{love}(x, y))$

7) Every student smiles

→ $\forall x \text{ student}(x) \rightarrow \text{smile}(x)$

8) Everyone walks or talks

→ $\forall x \text{ walks}(x) \vee \text{talks}(x)$

9) Every student except

→ $\forall x \text{ student}(x)$

10) Every student walks or talks

→ $\forall x \text{ student}(x) \rightarrow \text{walk}(x) \vee \text{talk}(x)$

11) Every student who walks or talks
 \rightarrow $\forall x$ student(x) \rightarrow (walk(x) \vee talk(x))

12) Every student who loves many is happy
 \rightarrow $\forall x$ student(x) \wedge loves(x, many) \rightarrow happy(x)

13) Every boy who loves many hates every boy who many loves
 \rightarrow $\forall x$ boy(x) \wedge loves(x, many) \rightarrow ($\forall y$ boy(y) \wedge (many, y) \rightarrow hates(x, y))

14) Every boy who loves many hates every other boy who many loves.
 \rightarrow $\forall x$ ((boy(x) \wedge loves(x, many)) \rightarrow $\forall y$ ((boy(y) \wedge loves(many, y) \wedge (y \neq x) \rightarrow hate(x, y)))

Q2. "As per the law, it is for an American to sell weapons to hostile nations, country A, an enemy of America, has some missiles, & all the missiles were sold to it by Robert who is an American citizen". prove that "Robert is criminal"

\rightarrow [By Forward & backward (chaining)]

American(x) \wedge weapon(y) \wedge sell(x, y, 2) \wedge enemy(x)

\rightarrow Criminal(x)
 owns(A, T)
 missile(T)

missile(x) \wedge owns(A, x) \rightarrow sell(Robert, x, A)
 American(Robert).

American(x) weapon(y) sell(x, y, 2) enemy(x)

missile(x) owns(x)

criminal(x)

Here in place of x we can get Robert hence we reached our goal statement! Here it is proved by Robert is Criminal by forward chaining.

Q3. Construct the truth table for:
 (P \rightarrow Q) \wedge (TP \rightarrow Q)

P	Q	TP	P \rightarrow Q	TP \rightarrow Q	(P \rightarrow Q) \wedge (TP \rightarrow Q)
T	T	F	T	T	T
T	F	F	F	T	F
F	T	T	T	T	T
F	F	T	T	F	F

Q4. Show that "If there is cream & there is a donut then, I will drink a coffee or if there is a no donut, then I will not drink a coffee" is valid.

\rightarrow c. There is a cream
 d: There is a donut
 !: I will drink a coffee.

Symbolic form:-
 (C \wedge D) \rightarrow K \wedge (C \vee \neg D) \rightarrow K

Graph Table:-

c g k CND ND NK ND&NK CND&NK

T	T	T	T	F	F	T	T
T	T	F	T	F	T	T	T
T	F	T	T	T	F	F	T
T	F	T	T	T	T	T	T
T	F	F	F	T	T	T	T
F	T	T	F	F	F	T	T
F	T	F	F	F	T	T	T
F	F	T	F	T	T	T	T
F	F	F	F	T	T	T	T

∴ Here all values are true.

∴ Given argument is valid.

[Signature]
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