Assignment 3 Solutions

1

Dollar is strong - D, Yuan is strong - Y, New US-China trade agreement signed - T

a. $T \implies D \land Y$

b. $D \implies \neg Y$

c. $\neg D \implies \neg T$

d. $T \implies \neg(D \land Y)$ my wrong first try $T \implies (\neg D \land Y) \lor (D \land \neg Y)$

e. $T \implies \neg D \land Y$

f. $T \implies Y \implies \neg D$

g. $T \implies (D \implies Y) \land (Y \implies D)$ (it's a biconditional). My wrong first try $T \implies Y \land D \implies \neg Y \land \neg D$

h. $T \implies (D \lor Y) \land \neg(D \land Y)$ (basically XOR). My wrong first try $T \implies (\neg D \land Y) \lor (D \land \neg Y)$

2

ϕ	$\neg\phi$	ψ	$\phi \implies \psi$	$\neg\phi \lor \psi$
T	F	T	T	T
T	F	F	F	F
F	T	T	T	T
F	T	F	T	T

3

The conclusion from the truth table above is that the conditional $\phi \implies \psi$ is equivalent to $\neg\phi \lor \psi$.

Example: Do not copy your homework, or you will fail. $\Leftrightarrow$ If you copy your homework, then you will fail.

4

ϕ	ψ	$\neg\psi$	$\phi \implies \psi$	$\phi \nRightarrow \psi$	$\phi \land \neg\psi$
T	T	F	T	F	F
T	F	T	F	T	T
F	T	F	T	F	F
F	F	T	T	F	F

5

The conclusion from the truth table above is that the condtional $\phi \nRightarrow \psi$ is equivalent to $\phi \land \neg\psi$. Which also can be derived by using the DeMorgan law:

$\phi \implies \psi \Leftrightarrow \neg\phi \lor \psi$

$\phi \nRightarrow \psi \Leftrightarrow \neg(\phi \implies \psi) \Leftrightarrow \neg(\neg\phi \lor \psi) \Leftrightarrow \phi \land \neg\psi$

6   PUZZLE

A woman was driving in her car along a black road. She did not have her car lights on. There was no moon and no light from the stars. A black dog was asleep in the middle of the road. As the woman approached the dog, she swerved to avoid it, and the animal slept on. How did the woman know to swerve around the dog?

6.1 Solution 1

Assign X to "It is night time"
Assign Y to "It is daytime"
It never says it's night $\neg X \implies Y$
In daytime it's easy to see the dog and swerve around it.

6.2 Solution 2

It might be a nighttime, because:
Assign X to "no light from the stars"
Assign Y to "it is night time"
Assign Z to "The sun is a star"
$X \wedge Z \implies Y$
Then:
Assign A to "car lights on"
Assign B to "interior lights on"
Assign C to "headlights on"
If
$A \implies B \vee C$
so
if A is false, given the truth table for conditionals: $B \vee C$ can be true or false, so the statement is true. if C is true, but B false $\implies$ her headlights were on, so she could see the dog and swerve around it.