HW 1 CprE 310

Jacob Boicken

1. h = "is healthy" w = "is wealthy" s = "is wise"

a.) $h \wedge w \wedge \neg s$
b.) $h \wedge \neg w \wedge s$
c.) $\neg h \wedge \neg w \wedge \neg s$ or $\neg(h \vee w \vee s)$

2. $a \equiv \neg(p \to q)$ $b \equiv q \wedge a$ $c \equiv p \to b \equiv p \to (q \wedge \neg(p \to q))$

p	q	a	b	c
T	T	F	T	T
T	F	T	T	T
F	T	F	T	T
F	F	F	F	T

is a tautology

3. a.)

p	q	$p \wedge q$	$\neg(p \wedge q)$	$p \uparrow q$
T	T	T	F	F
T	F	F	T	T
F	T	F	T	T
F	F	F	T	T

b.)

p	q	$p \uparrow q$	$(p \uparrow q) \uparrow (p \uparrow q)$	$p \wedge q$
T	T	F	T	T
T	F	T	F	F
F	T	T	F	F
F	F	T	F	F

c.)

p	q	$p \uparrow p$	$q \uparrow q$	$(p \uparrow p) \uparrow (q \uparrow q)$	$p \vee q$
T	T	F	F	T	T
T	F	F	T	T	T
F	T	T	F	T	T
F	F	T	T	F	F

d.)

p	$(p \uparrow p)$	$\neg p$
T	F	F
F	T	T

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4. A = "Ava is late" B = "Bob is late"
C = "class ends early"

a.) $A \to B$ b.) $(A \wedge B) \to C$

A	B	C	$A \to B$	$(A \wedge B) \to C$	$(A \to B) \wedge ((A \wedge B) \to C) \wedge (\neg C)$
T	T	T	T	T	F
T	T	F	T	F	F
T	F	T	F	T	F
T	F	F	F	T	F
F	T	T	T	T	F
F	T	F	T	T	T
F	F	T	T	T	F
F	F	F	T	T	T

We know class doesn't end early ($\neg C$) and both propositions $A \to B$ and $(A \wedge B) \to C$ must all be true, so we get a final proposition of $(A \to B) \wedge ((A \wedge B) \to C) \wedge (\neg C)$. that must be true. When this proposition is true, A is always F. This means if we know class doesn't end early, then we also know that Ava is on time / not late.

5. a.) $p \wedge q \wedge r$

b.) $\neg p \wedge r$

c.) $r \to p$

d.) $p \to r$

e.) $(r \to p) \wedge (p \to r)$

6.) a.) If a number is divisible by 9, then it is divisible by 3.
If a number is not divible by 3, then it isn't divisible by 9.

b.) If Jane is to pass the course, then he needs to do his homework.
If Jane does not do his homework, then he won't pass the course.

c.) If Jack's team wins the rest of their games, then they win the championship.
If Jacks team loses the championship, then they didn't win the rest of their games.