CSE 2321 Homework 1 Template

Problem 1

a

tautology

P	$\neg P$	$P \vee \neg P$
T	F	T
F	T	T

b

contradiction

P	$\neg P$	$P \wedge \neg P$
T	F	F
F	T	F

c

contingency

P	Q	R	$Q \vee R$	$P \wedge Q$	$P \wedge R$	$\neg(P \vee Q)$	$P \wedge (Q \vee R)$	$\neg(P \vee Q) \vee (P \wedge R)$
T	T	T	T	T	T	F	T	T
T	T	F	T	T	F	F	T	F
T	F	T	T	F	T	T	T	T
T	F	F	F	F	F	T	F	T
F	T	T	T	F	F	T	F	T
F	T	F	T	F	F	T	F	T
F	F	T	T	F	F	T	F	T
F	F	F	F	F	F	T	F	T

$P \wedge (Q \vee R) \Rightarrow \neg(P \vee Q) \vee (P \wedge R$
T
F
T
T
T
T
T
T

d

contingency

P	Q	$\neg P$	$\neg Q$	$P \wedge Q$	$\neg P \Rightarrow \neg Q$	$P \wedge Q \iff \neg P \Rightarrow \neg Q$
T	T	F	F	T	T	T
T	F	F	T	F	T	F
F	T	T	F	F	F	T
F	F	T	T	F	T	F

e

contingency

P	Q	$P \vee Q$	$\neg P$	$\neg Q$	$\neg(P \vee Q)$	$\neg P \vee \neg Q$	$\neg P \vee \neg Q \iff \neg(P \vee Q)$
T	T	T	F	F	F	F	T
T	F	T	F	T	F	T	F
F	T	T	T	F	F	T	F
F	F	F	T	T	T	T	T

f

contingency

P	Q	$P \wedge Q$	$\neg(P \wedge Q)$	$\neg P$	$\neg Q$	$\neg P \wedge \neg Q$	$\neg(P \wedge Q) \iff \neg P \wedge \neg Q$
T	T	T	F	F	F	F	T
T	F	F	T	F	T	F	F
F	T	F	T	T	F	F	F
F	F	F	T	T	T	T	T

g

contingency

P	Q	R	$Q \Rightarrow R$	$P \Rightarrow Q$	$\neg(Q \Rightarrow R)$	$(P \Rightarrow Q) \vee \neg(Q \Rightarrow R)$	$P \Rightarrow (Q \Rightarrow R)$
T	T	T	T	T	F	T	T
T	T	F	F	T	T	T	F
T	F	T	T	F	F	F	T
T	F	F	T	F	F	F	T
F	T	T	T	T	F	T	T
F	T	F	F	T	T	T	T
F	F	T	T	T	F	T	T
F	F	F	T	T	F	T	T

$P \Rightarrow (Q \Rightarrow R) \iff (P \Rightarrow Q) \vee \neg(Q \Rightarrow R)$
T
F
F
F
T
T
T
T

h

contingency

P	Q	$\neg P$	$\neg Q$	$P \vee Q$	$P \vee \neg Q$	$\neg P \vee Q$	$\neg P \vee \neg Q$
T	T	F	F	T	T	T	F
T	F	F	T	T	T	F	T
F	T	T	F	T	F	T	T
F	F	T	T	T	T	T	T

$(P \vee Q) \wedge (P \vee \neg Q) \wedge (\neg P \vee Q) \wedge (\neg P \vee \neg Q)$
F
F
F
T

i

P	Q	R	S
T	T	T	T
T	T	T	F
T	T	F	T
T	T	F	F
T	F	T	T
T	F	T	F
T	F	F	T
T	F	F	F
F	T	T	T
F	T	T	F
F	T	F	T
F	T	F	F
F	F	T	T
F	F	T	F
F	F	F	T
F	F	F	F

Problem 2

a

$$\neg Q \wedge P$$

b

$$R \wedge \neg P$$

c

$$R \iff Q$$

d

$$P \vee (Q \wedge \neg R)$$

e

$$P \wedge \neg R \Rightarrow Q$$

f

$$R \iff \neg Q$$

Problem 3

A sufficient condition would be that I am watching a YouTube video on my iPad, as the only way to do that is if my wifi is working.

Problem 4

A necessary but not sufficient condition would be that I am using a space telescope. You cannot see Jupiter with your bare eyes, so we know that if you don't have a telescope, you couldn't possibly see Jupiter, but just because you are using a telescope, doesn't mean that you can actually see Jupiter.

Problem 5

a

Note: Using a column to show the desired truth table results (the expression being replaced).

A	$\neg A$	$A \odot A$
T	F	F
F	T	T

b

A	B	$A \odot B$	$A \wedge B$	$(A \odot B) \odot (A \odot B)$
T	T	F	T	T
T	F	T	F	F
F	T	T	F	F
F	F	T	F	F