CENG424 - Homework 1

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1. (a)

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

As truth table shows, $A \to B \equiv \neg(A \ \wedge \neg B)$

(b)

A	B	$A \longleftrightarrow B$	$(\neg A \vee B) \wedge (\neg B \vee A)$
F	F	T	T
F	T	F	F
T	F	F	F
T	T	T	T

As truth table shows, $A \longleftrightarrow B \equiv (\neg A \vee B) \wedge (\neg B \vee A)$

(c)

A	B	$A \to (\neg A \to B)$	1
F	F	T	T
F	T	T	T
T	F	T	T
T	T	T	T

As truth table shows, $A \to (\neg A \to B) \equiv 1$

(d)

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

As truth table shows, $(A \vee \neg B) \to C \equiv (\neg A \wedge B) \vee C$

2. (a) $A \wedge (\neg A \to A) \equiv A \wedge (\neg\neg A \vee A) \equiv A \wedge (A \vee A) \equiv A \wedge A \equiv A$

(b) $\equiv (A \to B) \to ((A \to \neg B) \to \neg A)$

$\equiv (A \to B) \to ((\neg A \vee \neg B) \to \neg A)$

$\equiv (A \to B) \to (\neg(\neg A \vee \neg B) \vee \neg A)$

$\equiv (A \to B) \to (\neg(\neg A \vee \neg B) \vee \neg A)$

$\equiv (A \to B) \to (\neg\neg A \wedge \neg\neg B) \vee \neg A)$

$\equiv (A \to B) \to ((A \wedge B) \vee \neg A)$

$\equiv (A \to B) \to ((A \vee \neg A) \wedge (B \vee \neg A))$

$\equiv (A \to B) \to (T \wedge (B \vee \neg A))$

$\equiv (A \to B) \to (B \vee \neg A) \equiv (\neg A \vee B) \to (B \vee \neg A) \equiv \neg(\neg A \vee B) \vee (B \vee \neg A)$

$\equiv (A \wedge \neg B) \vee (B \vee \neg A) \equiv (A \vee B \vee \neg A) \wedge (\neg B \vee B \vee \neg A) \equiv T \wedge T \equiv T$

(c) $\equiv (\neg A \vee (B \vee \neg C)) \wedge \neg A \wedge B$

3. $F = (\neg A \wedge B) \wedge (\neg(B \wedge C)) \wedge (C \vee D) \wedge (\neg(\neg A \to D))$
Since all branches are closed for F = 1, F is not satisfiable and the given forms are not mutually consistent.