Student Information

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Answer 1

a) $A \to B$ and $\neg (A \land \neg B)$

A	В	$\neg B$	$A \to B$	$(A \land \neg B)$	$\neg (A \land \neg B)$
Т	Т	F	Т	F	Т
Т	F	Т	F	Т	F
F	Т	F	Т	F	Т
F	F	Т	Т	F	Τ

Table 1: Truth Table for $A \to B$ and $\neg (A \land \neg B)$

The truth table shows that $A \to B$ and $\neg (A \land \neg B)$ are equivalent.

b) $A \leftrightarrow B$ and $(\neg A \lor B) \land (\neg B \lor A)$

A	В	$\neg A$	$\neg B$	$A \leftrightarrow B$	$(\neg A \lor B)$	$(\neg B \lor A)$	$(\neg A \lor B) \land (\neg B \lor A)$
Т	Т	F	F	Т	Τ	Т	Т
Т	F	F	Т	F	F	Т	F
F	Т	Т	F	F	Τ	F	F
F	F	Т	Т	Т	Т	T	Т

Table 2: Truth Table for $A \leftrightarrow B$ and $(\neg A \lor B) \land (\neg B \lor A)$

The truth table shows that $A \leftrightarrow B$ and $(\neg A \lor B) \land (\neg B \lor A)$ are equivalent.

c) $A \to (\neg A \to B)$ and 1

A	$\neg A$	В	$\neg A \to B$	$A \to (\neg A \to B)$	1
T	F	Т	Τ	Т	Т
Т	F	F	Τ	Т	Т
F	Т	Т	Τ	T	Т
F	Т	F	F	T	Т

Table 3: Truth Table for $A \to (\neg A \to B)$ and 1

The truth table shows that $A \to (\neg A \to B)$ and 1 are equivalent.

d) $(A \vee \neg B) \to C$ and $(\neg A \wedge B) \vee C$

A	В	С	$\neg A$	$\neg B$	$A \vee \neg B$	$\neg A \wedge B$	$(A \vee \neg B) \to C$	$(\neg A \land B) \lor C$
Т	Т	Τ	F	F	Т	F	Τ	T
Т	Т	F	F	F	Т	F	F	F
Т	F	Т	F	Т	Т	F	Τ	T
Т	F	F	F	Т	Т	F	F	F
F	Т	Т	Т	F	F	Т	Τ	T
F	Т	F	Т	F	F	Т	T	Т
F	F	Τ	Т	Т	Т	F	T	T
F	F	F	Т	Т	Т	F	F	F

Table 4: Truth Table for $(A \vee \neg B) \to C$ and $(\neg A \wedge B) \vee C$

The truth table shows that $(A \vee \neg B) \to C$ and $(\neg A \wedge B) \vee C$ are equivalent.

Answer 2

a) $A \wedge (\neg A \rightarrow A)$

$$A \wedge (\neg A \to A) \equiv A \wedge (\neg \neg A \vee A) \tag{a}$$

$$\equiv A \land (A \lor A) \tag{b}$$

$$\equiv A \wedge A$$
 (c)

$$\equiv A$$
 (d)

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

$$(A \to B) \to ((A \to \neg B) \to \neg A) \equiv (\neg A \lor B) \to ((\neg A \lor \neg B) \to \neg A) \tag{a}$$

$$\equiv (\neg A \lor B) \to (\neg (\neg A \lor \neg B) \lor \neg A) \tag{b}$$

$$\equiv (\neg A \lor B) \to ((A \land B) \lor \neg A) \tag{c}$$

$$\equiv (\neg A \lor B) \to ((A \lor \neg A) \land (B \lor \neg A)) \tag{d}$$

$$\equiv (\neg A \lor B) \to (T \land (B \lor \neg A)) \tag{e}$$

$$\equiv (\neg A \lor B) \to (B \lor \neg A) \tag{f}$$

$$\equiv (\neg A \lor B) \to (\neg A \lor B) \tag{g}$$

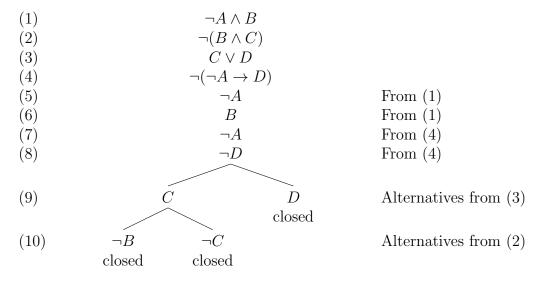
$$\equiv T$$
 (h)

c)
$$(A \rightarrow (B \lor \neg C)) \land \neg A \land B$$

$$(A \to (B \lor \neg C)) \land \neg A \land B \equiv (\neg A \lor (B \lor \neg C)) \land \neg A \land B$$
 (a)

$$\equiv (\neg A \lor B \lor \neg C) \land \neg A \land B$$
 (b)

Answer 3



This semantic tableaux shows that $\neg A \land B, \neg (B \land C), C \lor D, \neg (\neg A \to D)$ are not mutually consistent.