

Assignment #1 – Due Friday 9/2 by 5pm

1. Write a complete truth table for the following propositional-logic statements. Identify whether or not the statement is a tautology.

(a) $A \rightarrow (B \rightarrow C) \leftrightarrow A \wedge B \rightarrow C$

(b) $(A \vee B) \wedge (A \rightarrow C) \wedge (B \rightarrow C) \leftrightarrow C$

2. Verify each of the following tautological equivalence via a sequence of known tautological equivalences. State the name of each equivalence used.

(a) $(A \vee (A' \wedge B))' \leftrightarrow (A \vee B)'$

(b) $(A \rightarrow B) \wedge (A \rightarrow C) \leftrightarrow A \rightarrow (B \wedge C)$

ⓐ

A	B	C	$B \rightarrow C$	$A \wedge B$	$A \wedge B \rightarrow C$	$A \rightarrow (B \rightarrow C)$	$A \rightarrow (B \rightarrow C) \leftrightarrow A \wedge B \rightarrow C$
T	T	T	T	T	T	T	T
T	T	F	F	T	F	F	T
T	F	T	T	F	T	T	T
T	F	F	T	F	T	T	T
F	T	T	T	F	T	T	T
F	T	F	F	F	T	T	T
F	F	T	T	F	T	T	T
F	F	F	T	F	T	T	T

Statement is a tautology

ⓑ

A	B	C	$A \vee B$	$A \rightarrow C$	$B \rightarrow C$	$(A \vee B) \wedge (A \rightarrow C) \wedge (B \rightarrow C)$	$(A \vee B) \wedge (A \rightarrow C) \wedge (B \rightarrow C) \leftrightarrow C$
T	T	T	T	T	T	T	T
T	T	F	T	F	F	F	T
T	F	T	T	T	T	T	T
T	F	F	T	F	T	F	T
F	T	T	T	T	T	T	T
F	T	F	T	T	F	F	T
F	F	T	F	T	T	F	F
F	F	F	F	T	T	F	T

Statement is not a tautology

$$2 \text{ (a)} \quad [A \vee (A' \wedge B)]' \xleftrightarrow{\text{DeMorgan}} A' \wedge (A' \wedge B)' \xleftrightarrow{\text{DeMorgan}} A' \wedge (A \vee B') \xleftrightarrow{\text{distribution}}$$

$$(A' \wedge A) \vee (A' \wedge B') \xleftrightarrow{\text{complement}} 0 \vee (A' \wedge B') \xleftrightarrow{\text{Identity}} A' \wedge B' \xleftrightarrow{\text{DeMorgan}} (A \vee B)'$$

$$\text{(b)} \quad (A \rightarrow B) \wedge (A \rightarrow C) \xleftrightarrow[\text{x2}]{\text{Implication}} (A' \vee B) \wedge (A' \vee C) \xleftrightarrow{\text{distribution}} A' \vee (B \wedge C)$$

$$\xleftrightarrow{\text{Implication}} A \rightarrow B \wedge C$$