Zackery Field

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CS 70, Summer 2013

Homework 1

Problem 1 (12 Points)

1a. $P \wedge (Q \vee P) \equiv P \wedge Q$

Р	Q	$P \wedge (Q \vee P)$	$P \wedge Q$
Τ	Т	T	Т
\mathbf{T}	\mathbf{F}	${ m T}$	\mathbf{F}
\mathbf{F}	Т	F	F
\mathbf{F}	F	F	F

The pair is not equivalent.

1b.
$$(P \Rightarrow Q) \Rightarrow R \equiv P \Rightarrow (Q \Rightarrow R)$$

Р	Q	R	$(P \Rightarrow Q) \Rightarrow R$	$P \Rightarrow (Q \Rightarrow R)$
Τ	Т	Т	${ m T}$	Т
\mathbf{T}	\mathbf{F}	T	${ m T}$	${ m T}$
F	Γ	Т	${ m T}$	T
F	F	Т	${ m T}$	${ m T}$
Τ	Γ	F	${ m F}$	F
${ m T}$	F	F	${ m T}$	${ m T}$
\mathbf{F}	Γ	F	\mathbf{F}	${ m T}$
\mathbf{F}	F	F	\mathbf{F}	${ m T}$

The pair is not equivalent.

1c. $(P \Rightarrow Q) \Rightarrow (P \Rightarrow R) \equiv P \Rightarrow (Q \Rightarrow R)$

Р	Q	R	$(P \Rightarrow Q) \Rightarrow (P \Rightarrow R)$	$P \Rightarrow (Q \Rightarrow R)$
Τ	Т	Т	T	T
Τ	F	${ m T}$	T	T
\mathbf{F}	Т	\mathbf{T}	${ m T}$	T
\mathbf{F}	F	\mathbf{T}	${ m T}$	T
Τ	Т	F	F	\mathbf{F}
Τ	F	\mathbf{F}	T	${ m T}$
\mathbf{F}	Т	\mathbf{F}	${ m T}$	T
\mathbf{F}	F	\mathbf{F}	${ m T}$	T

The pair is equivalent.

1d. $(P \land \neg Q) \Leftrightarrow (\neg P \lor Q) \equiv (Q \land \neg P) \Leftrightarrow (\neg Q \lor P)$

P	Q	$P \wedge \neg Q$	$\neg P \lor Q$	$Q \wedge \neg P$	$\neg Q \lor P$	$(P \land \neg Q) \Leftrightarrow (\neg P \lor Q)$	$(Q \land \neg P) \Leftrightarrow (\neg Q \lor P)$
T	Т	F	Τ	F	Τ	F	F
${ m T}$	F	T	\mathbf{F}	F	${ m T}$	${ m F}$	${ m F}$
\mathbf{F}	T	F	${ m T}$	Γ	\mathbf{F}	F	F
F	F	F	T	F	${ m T}$	F	F

The pair is equivalent.