

Week03 Logically

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October 2025

20) $p \leftrightarrow q$ and $(p \wedge q) \vee (!p \wedge !q)$ are logically equivalent

p	q	$p \leftrightarrow q$	$p \wedge q$	$!p \wedge !q$	$(p \wedge q) \vee (!p \wedge !q)$
0	0	1	0	1	1
0	1	0	0	0	0
1	0	0	0	0	0
1	1	1	1	1	1

21) $!(p \leftrightarrow q)$ and $p \leftrightarrow !q$ are logically equivalent

p	q	$!p$	$!q$	$!(p \leftrightarrow q)$	$p \leftrightarrow !q$
0	0	1	1	0	0
0	1	1	0	1	1
1	0	0	1	1	1
1	1	0	0	0	0

22) $p \rightarrow q$ and $!q \rightarrow !p$ are logically equivalent

p	q	!p	!q	$p \rightarrow q$	$!q \rightarrow !p$
0	0	1	1	1	1
0	1	1	0	1	1
1	0	0	1	0	0
1	1	0	0	1	1

23) $!p \leftrightarrow q$ and $p \leftrightarrow !q$ are logically equivalent

p	q	!p	!q	$!p \leftrightarrow q$	$p \leftrightarrow !q$
0	0	1	1	0	0
0	1	1	0	1	1
1	0	0	1	1	1
1	1	0	0	0	0

24) $!(p \oplus q)$ and $p \leftrightarrow q$ are logically equivalent

$\oplus = \text{xor}$

p	q	$!(p \oplus q)$	$p \leftrightarrow q$
0	0	1	1
0	1	0	0
1	0	0	0
1	1	1	1

25) $\neg(p \leftrightarrow q)$ and $\neg p \leftrightarrow q$ are logically equivalent

p	q	$\neg p$	$\neg(p \leftrightarrow q)$	$\neg p \leftrightarrow q$
0	0	1	0	0
0	1	1	1	1
1	0	0	1	1
1	1	0	0	0

26) $(p \rightarrow q) \wedge (p \rightarrow r)$ and $p \rightarrow (q \wedge r)$ are logically equivalent

p	q	r	$p \rightarrow q$	$p \rightarrow r$	$q \wedge r$	$(p \rightarrow q) \wedge (p \rightarrow r)$	$p \rightarrow (q \wedge r)$
0	0	1	1	1	0	1	1
0	1	1	1	1	1	1	1
0	0	0	1	1	0	1	1
0	1	0	1	1	0	1	1
1	0	1	0	1	0	0	0
1	1	1	1	1	1	1	1
1	0	0	0	0	0	0	0
1	1	0	1	0	0	0	0