Math 210 Homework #1

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How many rows appear in a truth table for each of these compound propositions?

The amount of rows a complete truth table requires is found by noting the relation between the amount of variables, and the possible values for each variable (in this case binary). The anonymous function can be written as such:

$$x \mapsto 2^x \tag{1}$$

a) $p \implies \neg p$

$$\begin{aligned}&(x \mapsto 2^x)\,(1)\\ &= 2^{(1)}\\ &= 2\end{aligned}$$

b) $(p \vee \neg r) \wedge (q \vee \neg s)$

$$\begin{aligned}&(x \mapsto 2^x)\,(4)\\ &= 2^{(4)}\\ &= 16\end{aligned}$$

c) $q \vee p \vee \neg s \vee \neg r \vee \neg t \vee u$

$$\begin{aligned}&(x \mapsto 2^x)\,(6)\\ &= 2^{(6)}\\ &= 64\end{aligned}$$

d) $(p \wedge r \wedge t) \iff (q \wedge t)$

$$\begin{aligned}&(x \mapsto 2^x)\,(4)\\ &= 2^{(4)}\\ &= 16\end{aligned}$$

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How many rows appear in a truth table for each of these compound propositions?

The same anonymous function (1) can be utilized to found the amount of rows.

a) $(q \implies \neg p) \vee (\neg p \implies \neg q)$

$$\begin{aligned}&(x \mapsto 2^x)\,(2)\\ &= 2^{(2)}\\ &= 4\end{aligned}$$

b) $(p \vee \neg t) \wedge (p \vee \neg s)$

$$\begin{aligned}&(x \mapsto 2^x)\,(3)\\ &= 2^{(3)}\\ &= 8\end{aligned}$$

c) $(p \implies r) \vee (\neg s \implies \neg t) \vee (\neg u \implies v)$

$$\begin{aligned}&(x \mapsto 2^x)\,(6)\\ &= 2^{(6)}\\ &= 64\end{aligned}$$

d) $(p \wedge r \wedge s) \vee (q \wedge t) \vee (r \wedge \neg t)$

$$\begin{aligned}&(x \mapsto 2^x)\,(5)\\ &= 2^{(5)}\\ &= 32\end{aligned}$$

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Construct a truth table for each of these compound propositions.

a) $p \wedge \neg p$

p	$\neg p$	$p \wedge \neg p$
T	F	F
F	T	F

b) $p \vee \neg p$

p	$\neg p$	$p \vee \neg p$
T	F	T
F	T	T

c) $(p \vee \neg q) \implies q$

p	q	$\neg q$	$(p \vee \neg q)$	$(p \vee \neg q) \implies q$
T	T	F	T	T
T	F	T	T	F
F	T	F	F	T
F	F	T	T	F

d) $(p \vee q) \implies (p \wedge q)$

p	q	$(p \vee q)$	$(p \wedge q)$	$(p \vee q) \implies (p \wedge q)$
T	T	T	T	T
T	F	T	F	F
F	T	T	F	F
F	F	F	F	T

e) $(p \implies q) \iff (\neg q \implies \neg p)$

p	q	$(p \implies q)$	$\neg q$	$\neg p$	$(\neg q \implies \neg p)$	$(p \implies q) \iff (\neg q \implies \neg p)$
T	T	T	F	F	T	T
T	F	F	T	F	F	T
F	T	T	F	T	T	T
F	F	T	T	T	T	T

f) $(p \implies q) \implies (q \implies p)$

p	q	$(p \implies q)$	$(q \implies p)$	$(p \implies q) \implies (q \implies p)$
T	T	T	T	T
T	F	F	T	T
F	T	T	F	F
F	F	T	T	T

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Construct a truth table for $((p \implies q) \implies r) \implies s$.

p	q	r	s	$(p \implies q)$	$((p \implies q) \implies r)$	$((p \implies q) \implies r) \implies s$
T	T	T	T	T	T	T
T	T	T	F	T	T	F
T	T	F	T	T	F	T
T	T	F	F	T	F	T
T	F	T	T	F	T	T
T	F	T	F	F	T	F
T	F	F	T	F	T	T
T	F	F	F	F	T	F
F	T	T	T	T	T	T
F	T	T	F	T	T	F
F	T	F	T	T	F	T
F	T	F	F	T	F	T
F	F	T	T	T	T	T
F	F	T	F	T	T	F
F	F	F	T	T	F	T
F	F	F	F	T	F	T

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Construct a truth table for $(p \iff q) \iff (r \iff s)$.

p	q	r	s
T	T	T	T
T	T	T	F
T	T	F	T
T	T	F	F
T	F	T	T
T	F	T	F
T	F	F	T
T	F	F	F
F	T	T	T
F	T	T	F
F	T	F	T
F	T	F	F
F	F	T	T
F	F	T	F
F	F	F	T
F	F	F	F

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